

Learning Optimal Decision Trees using Constraint Programming

CP2025 - Constraints Journal Prominent Paper Award

Hélène Verhaeghe¹, Siegfried Nijssen¹, Gilles Pesant², Claude-Guy Quimper³, and Pierre Schaus¹

13 August 2025

¹ICTEAM, UCLouvain, Place Sainte Barbe 2, 1348 Louvain-la-Neuve, Belgium, {firstname.lastname}@uclouvain.be

²Polytechnique Montréal, Montréal, Canada, gilles.pesant@polymtl.ca

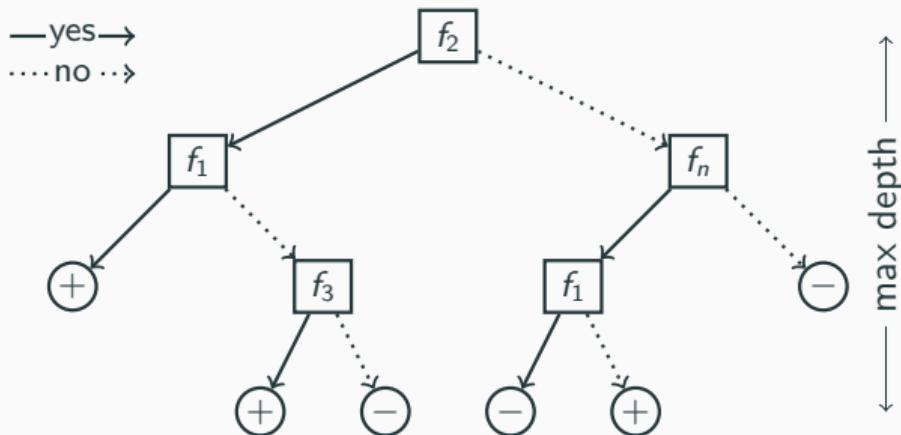
³Université Laval, Québec, Canada, claude — guy.quimper@ift.ulaval.ca



Database					
f_1	f_2	f_3	\dots	f_n	c
1	0	1	\dots	1	+
0	1	0	\dots	1	-
1	1	0	\dots	0	+
0	0	0	\dots	0	+
1	0	0	\dots	0	+
0	1	1	\dots	1	-
1	1	1	\dots	0	-
\vdots	\vdots	\vdots	\ddots	\vdots	\vdots
1	1	1	\dots	1	+

The Problem

Database					
f_1	f_2	f_3	...	f_n	c
1	0	1	...	1	+
0	1	0	...	1	-
1	1	0	...	0	+
0	0	0	...	0	+
1	0	0	...	0	+
0	1	1	...	1	-
1	1	1	...	0	-
⋮	⋮	⋮	⋮	⋮	⋮
1	1	1	...	1	+

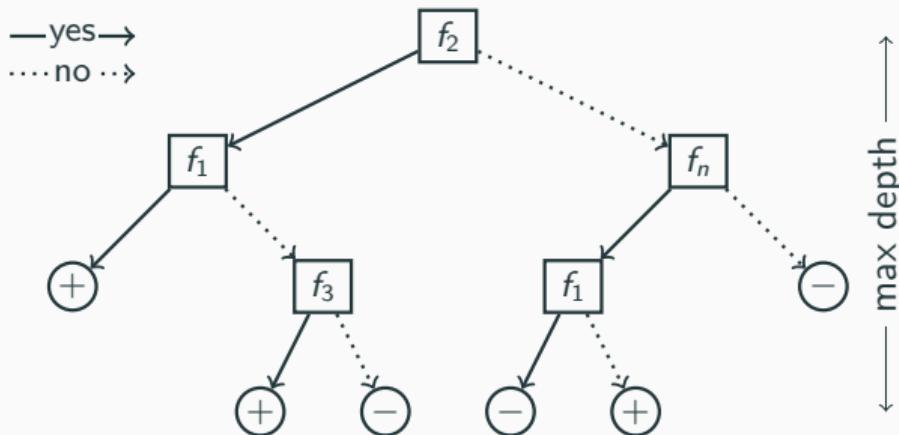


$$\min \sum (pred(i) - c(i))$$

The Problem

Database					
f_1	f_2	f_3	...	f_n	c
1	0	1	...	1	+
0	1	0	...	1	-
1	1	0	...	0	+
0	0	0	...	0	+
1	0	0	...	0	+
0	1	1	...	1	-
1	1	1	...	0	-
⋮	⋮	⋮	⋮	⋮	⋮
1	1	1	...	1	+

New sample					
0	0	1	...	0	?

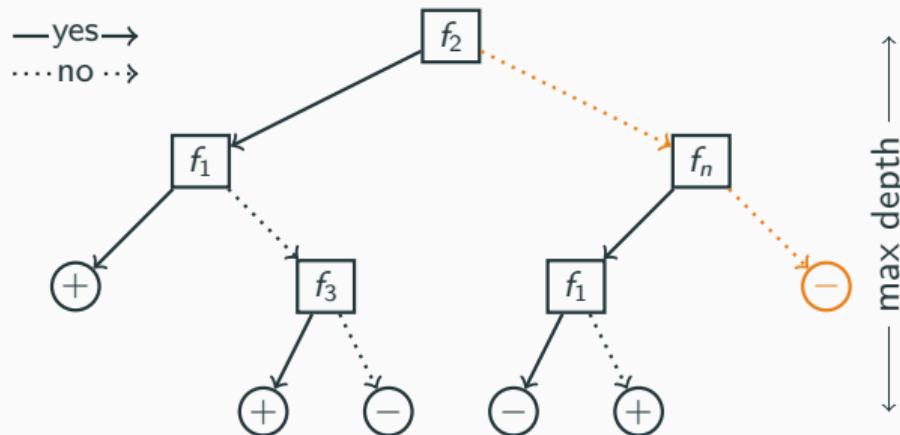


$$\min \sum (pred(i) - c(i))$$

The Problem

Database					
f_1	f_2	f_3	...	f_n	c
1	0	1	...	1	+
0	1	0	...	1	-
1	1	0	...	0	+
0	0	0	...	0	+
1	0	0	...	0	+
0	1	1	...	1	-
1	1	1	...	0	-
⋮	⋮	⋮	⋮	⋮	⋮
1	1	1	...	1	+

New sample					
0	0	1	...	0	—



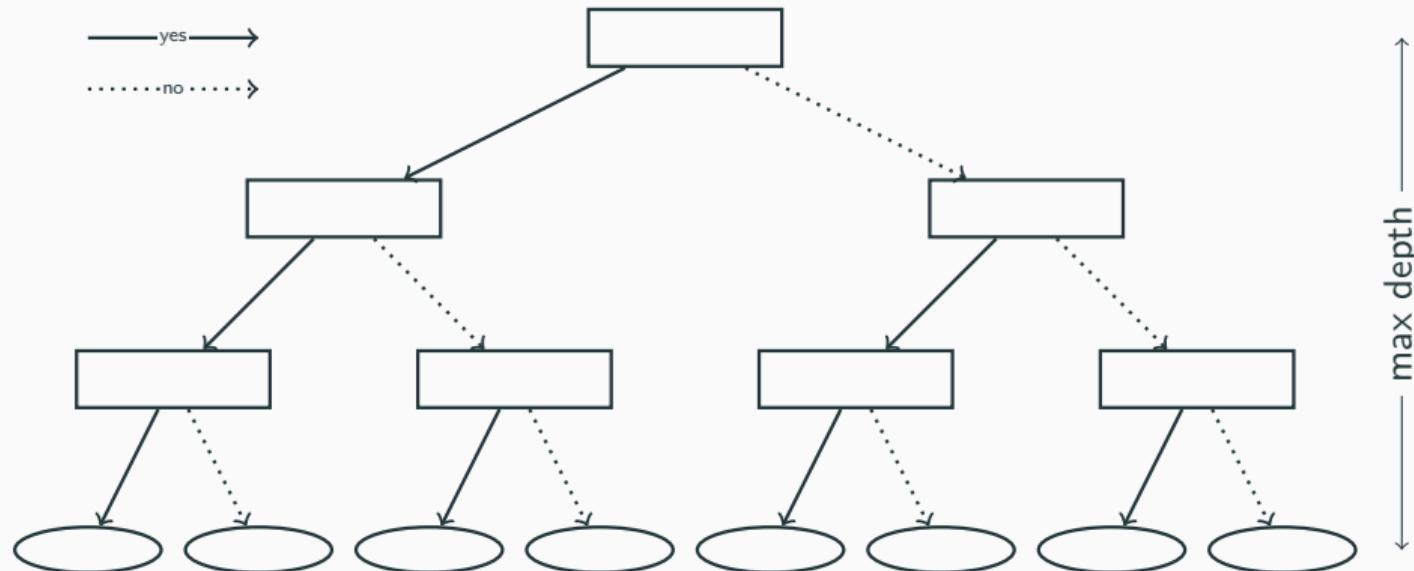
$$\min \sum (pred(i) - c(i))$$

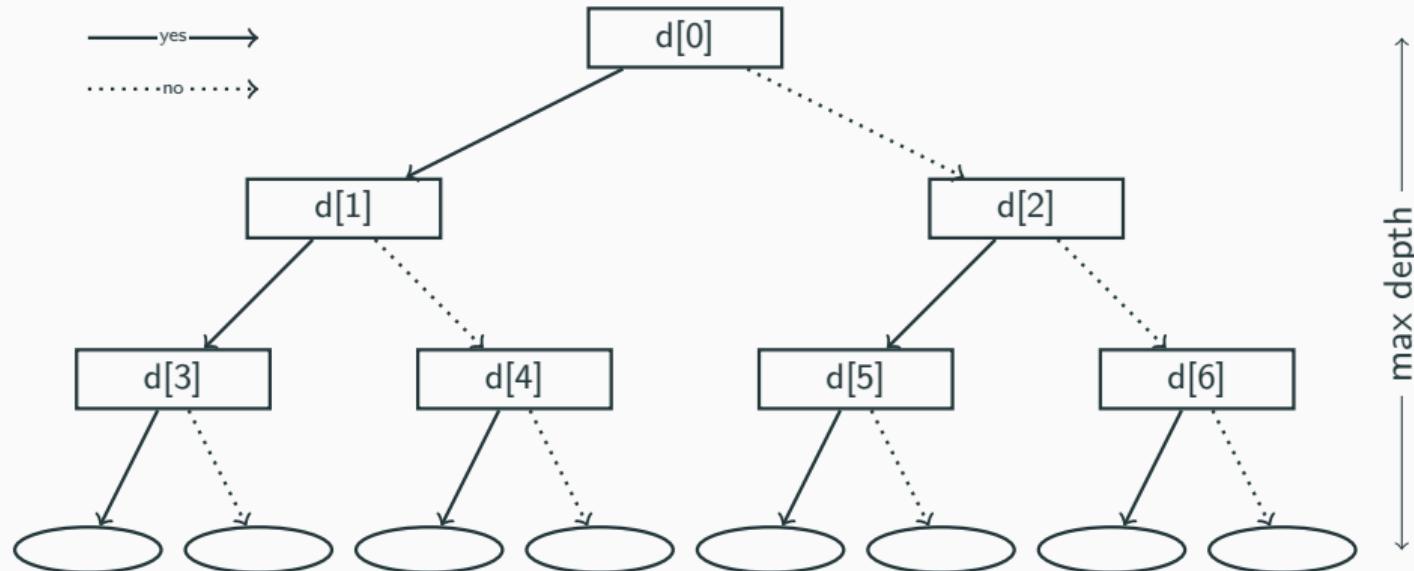
Greedy methods:

- ✓ easy construction
- ✗ hard to impose additional constraints
- ✗ potentially unnecessarily complex tree

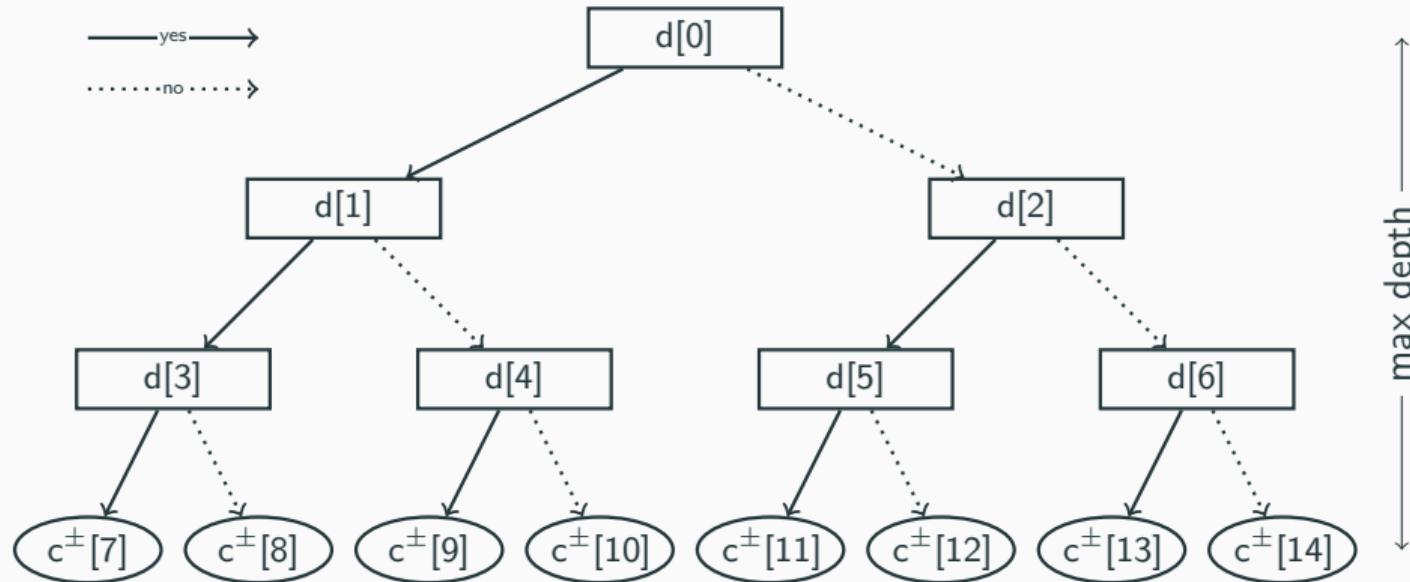
- Mining optimal decision trees from itemset lattices, Nijssen, S., Fromont, E., 2007
- Minimising decision tree size as combinatorial optimisation, Bessiere, C., Hebrard, E., O'Sullivan, B., 2009
- Optimal constraint-based decision tree induction from itemset lattices, Nijssen, S., Fromont, É., 2010
- **Optimal classification trees**, Bertsimas, D., Dunn, J., 2017
- Learning optimal decision trees with sat, Narodytska, N., Ignatiev, A., Pereira, F., Marques-Silva, J., RAS, I., 2018
- Learning optimal and fair decision trees for non-discriminative decision-making, Aghaei, S., Azizi, M.J., Vayanos, P., 2019
- Learning optimal classification trees using a binary linear program formulation, Verwer, S., Zhang, Y., 2019

CP Model



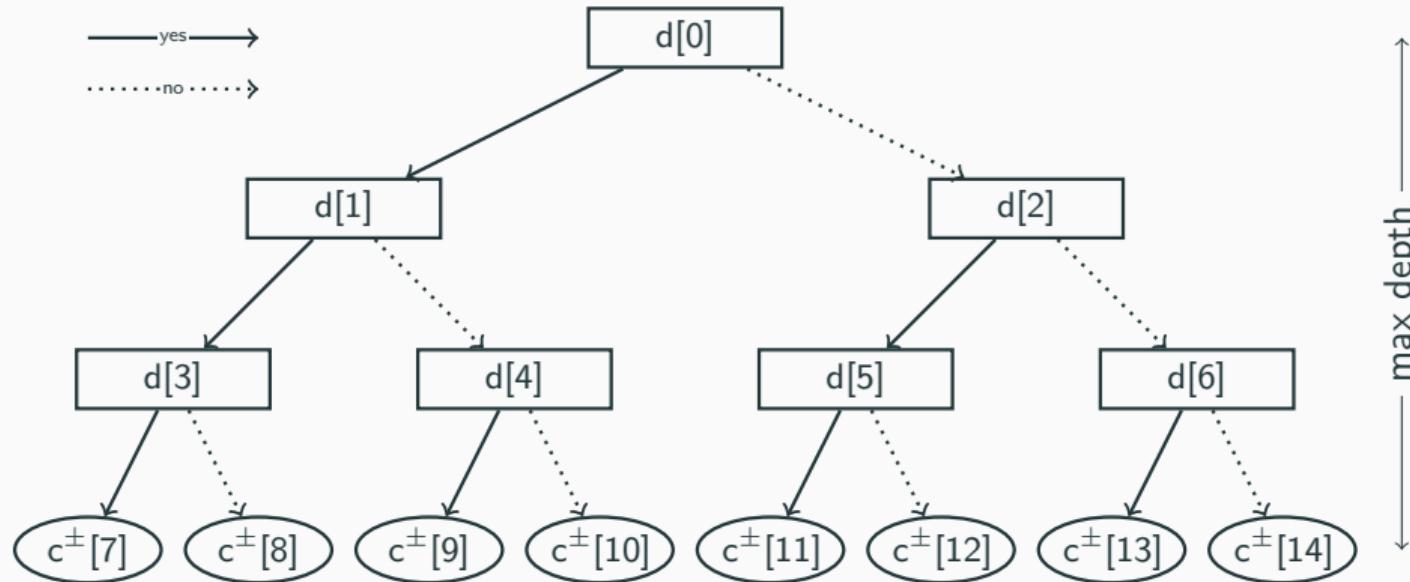


$$\text{dom}(d[i]) = \{1, \dots, n\}$$



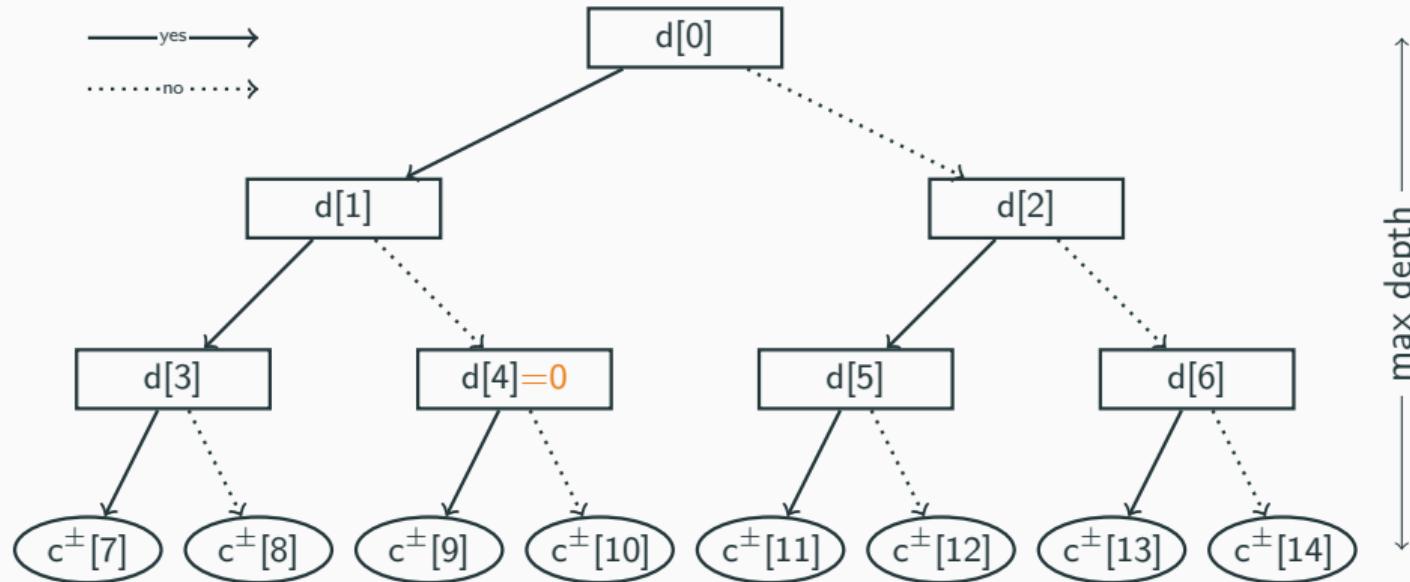
$$\text{dom}(d[i]) = \{1, \dots, n\}$$

$$\text{dom}(c[i]) = \{0, \dots, N\}$$



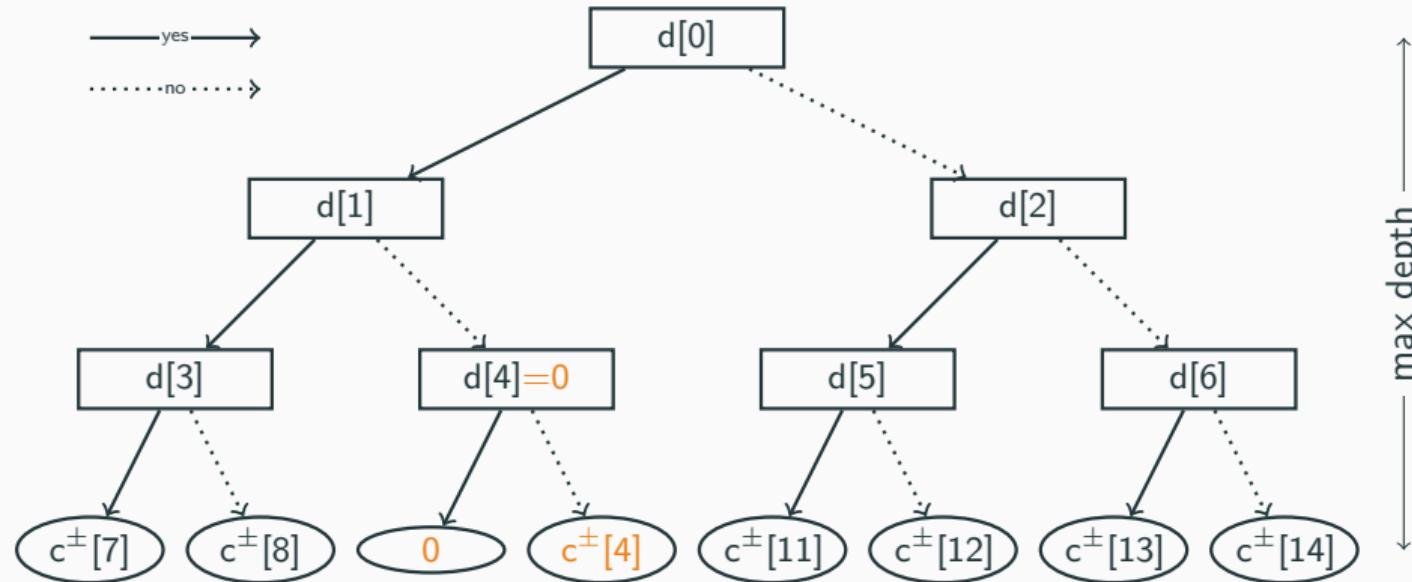
$$\text{dom}(d[i]) = \{0, 1, \dots, n\}$$

$$\text{dom}(c[i]) = \{0, \dots, N\}$$



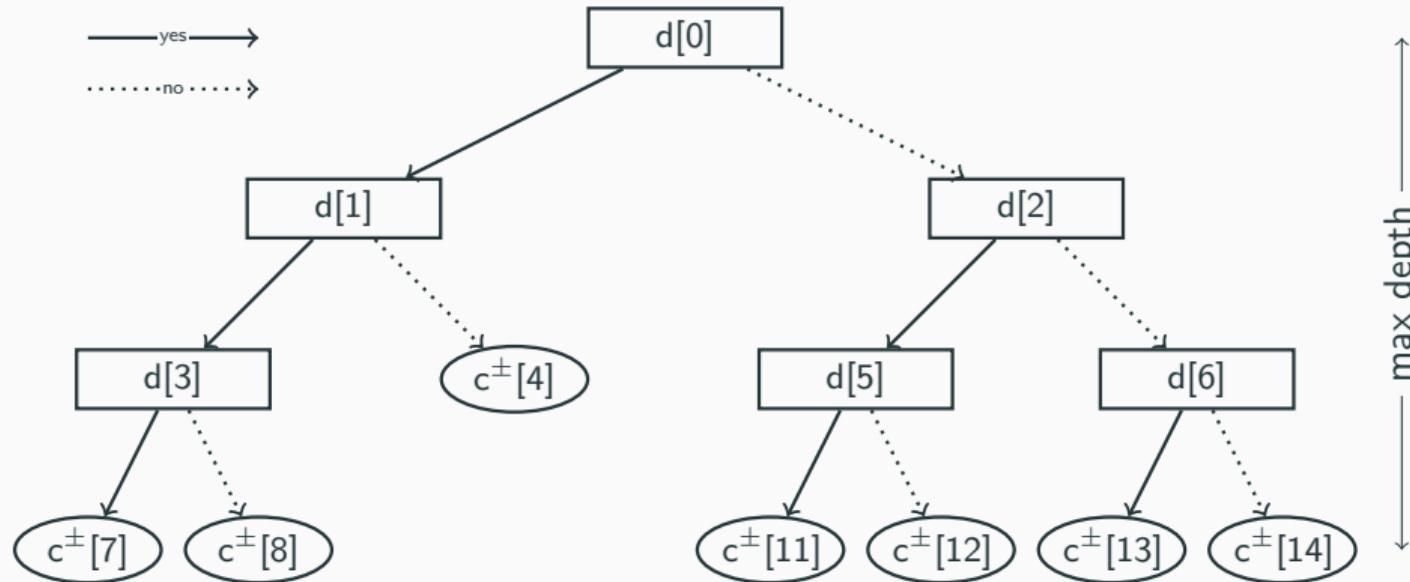
$$\text{dom}(d[i]) = \{0, 1, \dots, n\}$$

$$\text{dom}(c[i]) = \{0, \dots, N\}$$



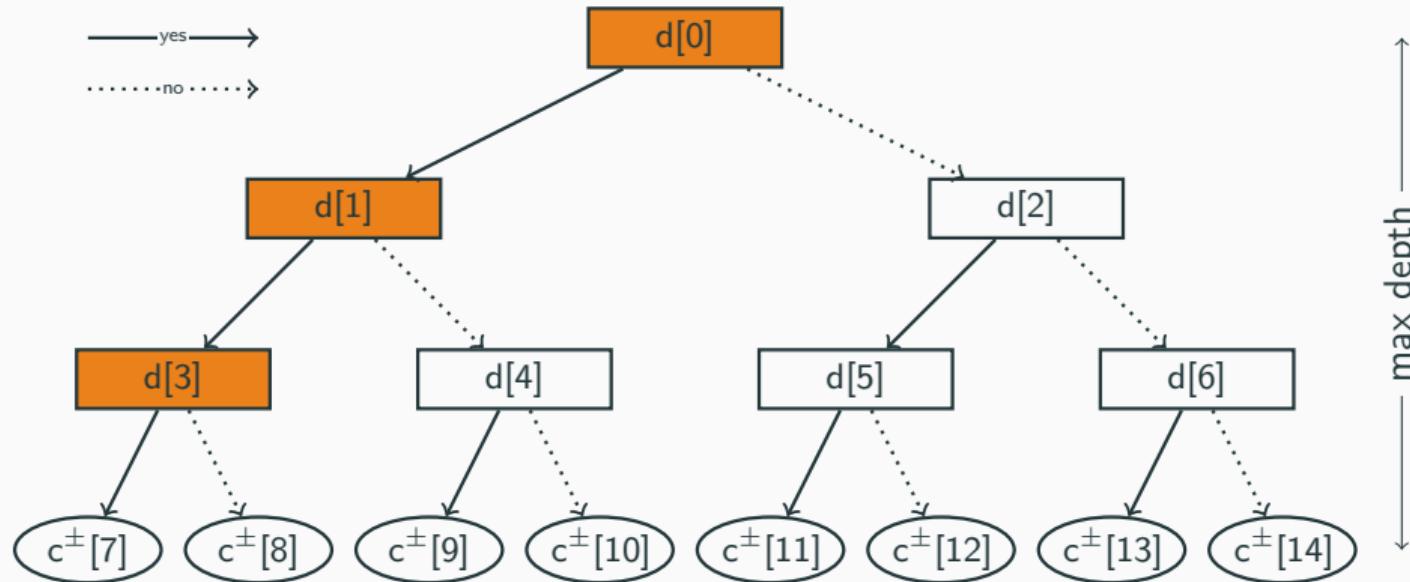
$$\text{dom}(d[i]) = \{0, 1, \dots, n\}$$

$$\text{dom}(c[i]) = \{0, \dots, N\}$$



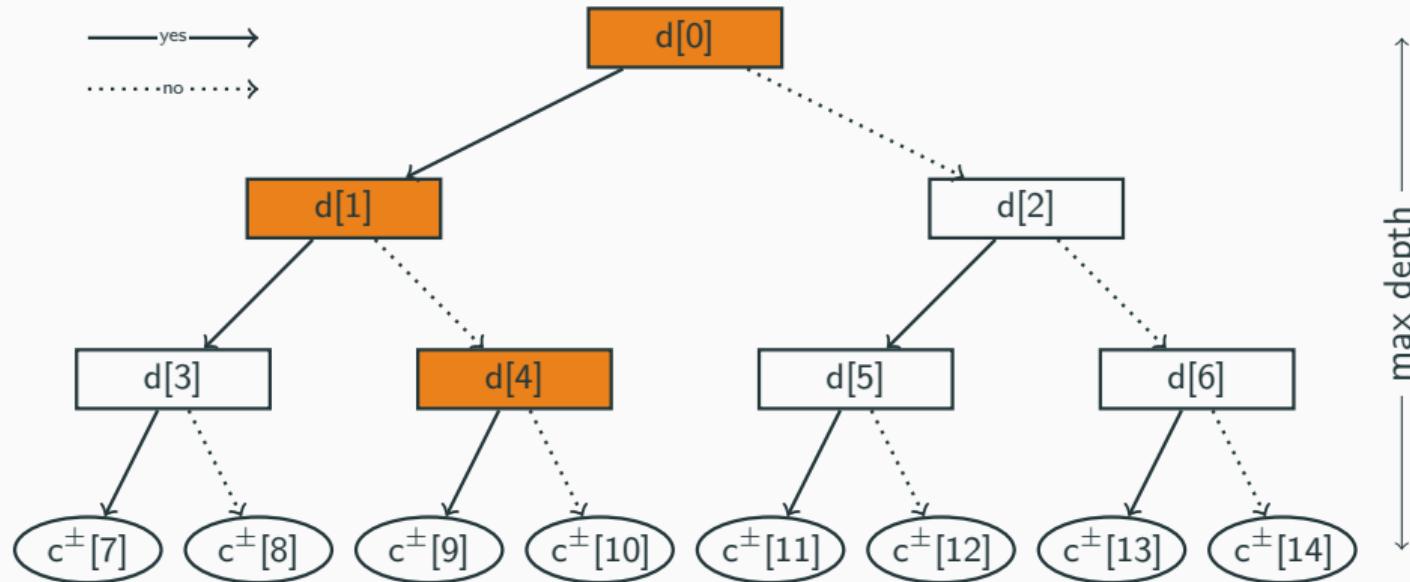
$$\text{dom}(d[i]) = \{0, 1, \dots, n\}$$

$$\text{dom}(c[i]) = \{0, \dots, N\}$$



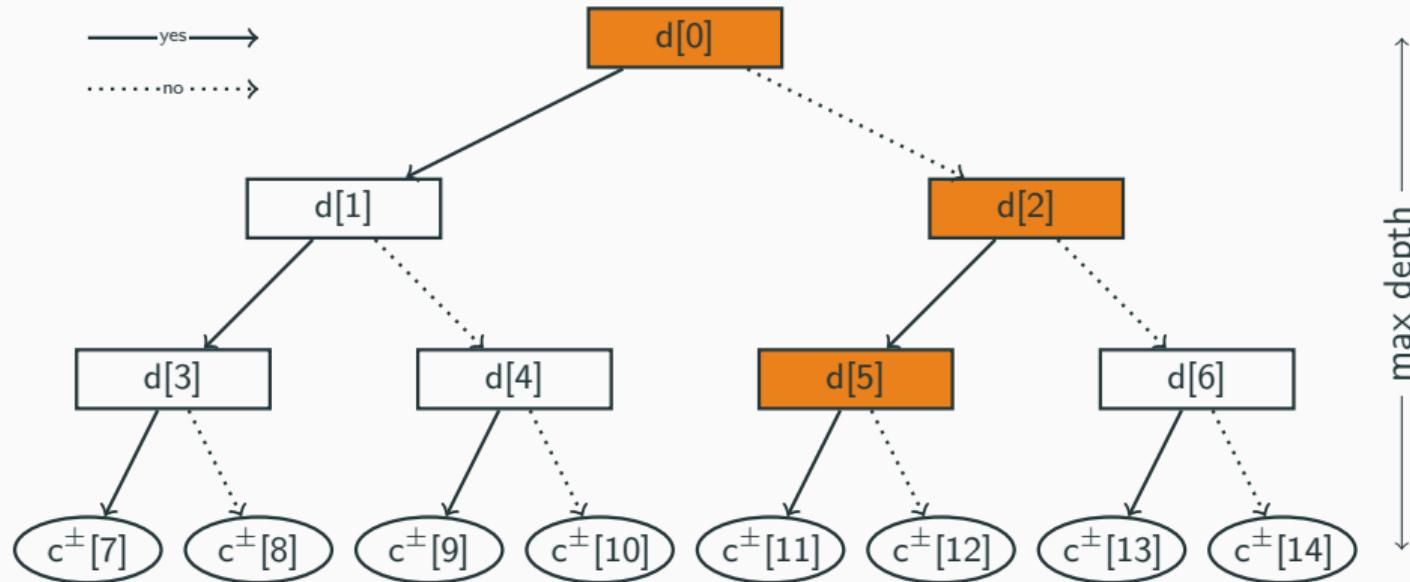
$$\text{dom}(d[i]) = \{0, 1, \dots, n\}$$

$$\text{dom}(c[i]) = \{0, \dots, N\}$$



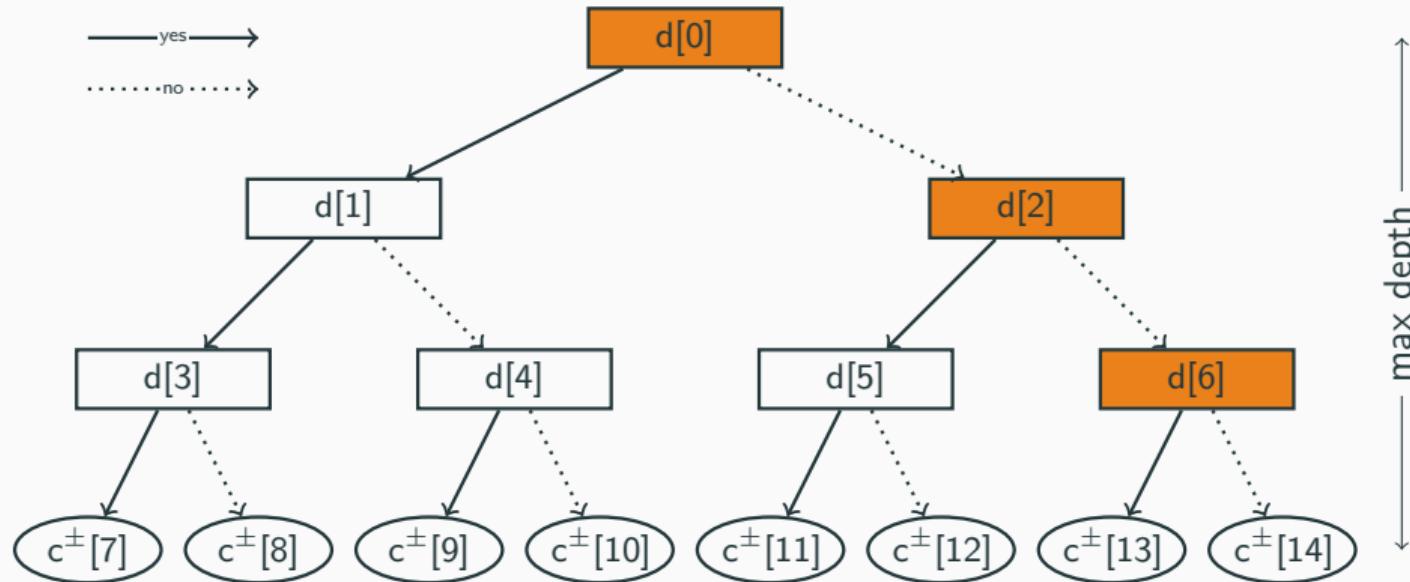
$$\text{dom}(d[i]) = \{0, 1, \dots, n\}$$

$$\text{dom}(c[i]) = \{0, \dots, N\}$$



$$\text{dom}(d[i]) = \{0, 1, \dots, n\}$$

$$\text{dom}(c[i]) = \{0, \dots, N\}$$



$$\text{dom}(d[i]) = \{0, 1, \dots, n\}$$

$$\text{dom}(c[i]) = \{0, \dots, N\}$$

f_1	f_2	f_3	f_4
1	0	1	1
0	1	0	1
1	1	0	0
0	0	0	0
1	0	0	0
0	1	1	1
1	1	1	0
1	1	1	1

Features (Dense)				Counter
x_1	x_2	x_3	x_4	

f_1	f_2	f_3	f_4
1	0	1	1
0	1	0	1
1	1	0	0
0	0	0	0
1	0	0	0
0	1	1	1
1	1	1	0
1	1	1	1

Features (Dense)				Counter
x_1	x_2	x_3	x_4	
0	1	0	1	

f_1	f_2	f_3	f_4
1	0	1	1
0	1	0	1
1	1	0	0
0	0	0	0
1	0	0	0
0	1	1	1
1	1	1	0
1	1	1	1

Features (Dense)				Counter
x_1	x_2	x_3	x_4	
0	1	0	1	3

f_1	f_2	f_3	f_4
1	0	1	1
0	1	0	1
1	1	0	0
0	0	0	0
1	0	0	0
0	1	1	1
1	1	1	0
1	1	1	1

Features (Dense)				Counter
x_1	x_2	x_3	x_4	
0	1	0	1	3

- Dense representation
- No feature rejection

f_1	f_2	f_3	f_4
1	0	1	1
0	1	0	1
1	1	0	0
0	0	0	0
1	0	0	0
0	1	1	1
1	1	1	0
1	1	1	1

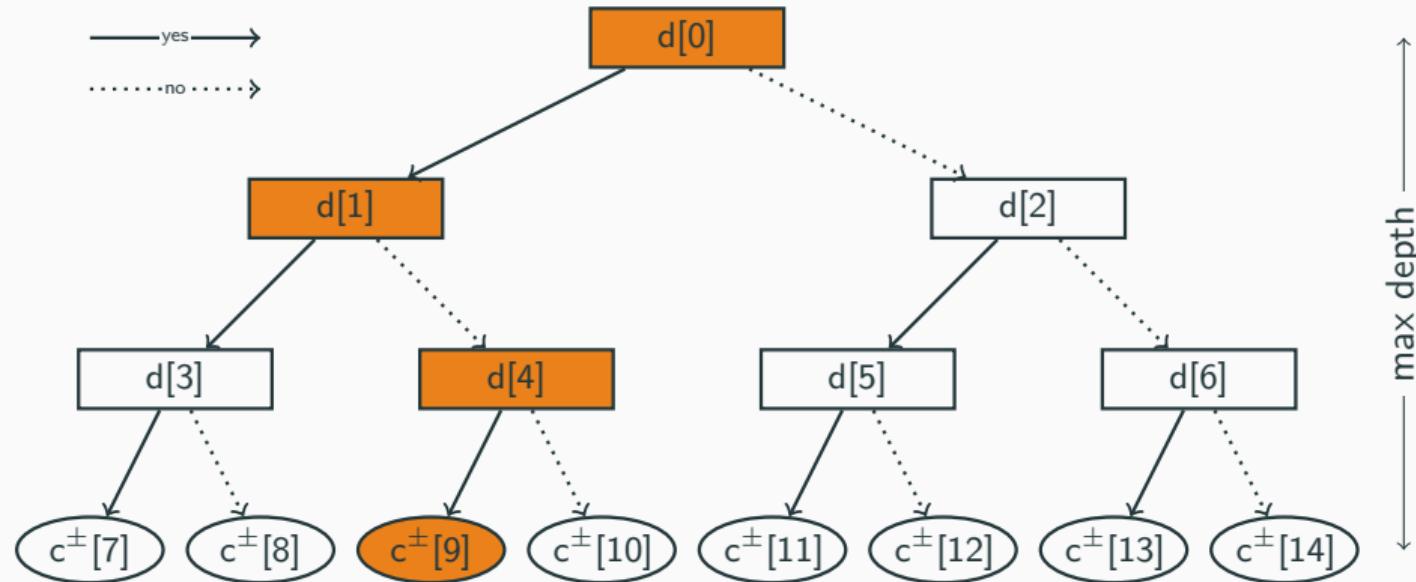
Features (Sparse)		Counter
y_1	y_2	
2	4	3

- Dense representation
- No feature rejection

f_1	f_2	f_3	f_4
1	0	1	1
0	1	0	1
1	1	0	0
0	0	0	0
1	0	0	0
0	1	1	1
1	1	1	0
1	1	1	1

✓ Features (Sparse)		✗ Features (Sparse)		Counter
y_1	y_2	z_1		
2	4	3		1

- Dense representation
- No feature rejection

 $\text{Coversize}(\{d[0], d[4]\}, \{d[1]\}, c^+[9])$ $\text{Coversize}(\{d[0], d[4]\}, \{d[1]\}, c^-[9])$

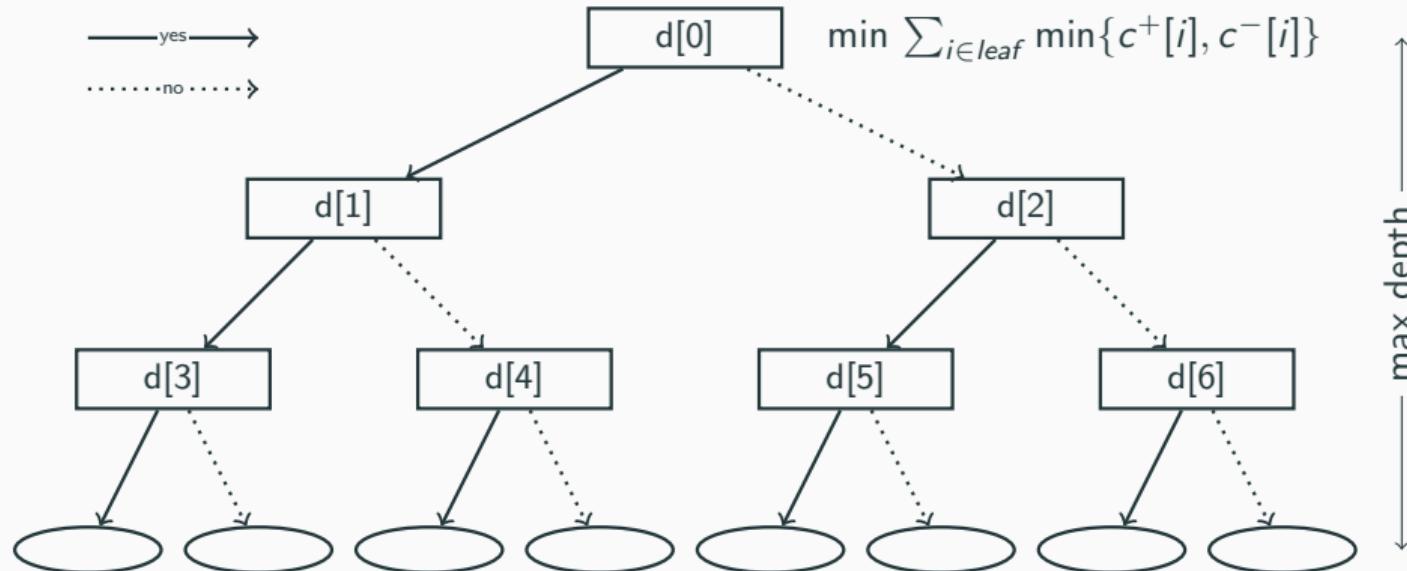
- constraints imposing minimum at leaf

$$c^+[i] + c^-[i] \geq N_{min}$$

- constraints avoiding useless decisions

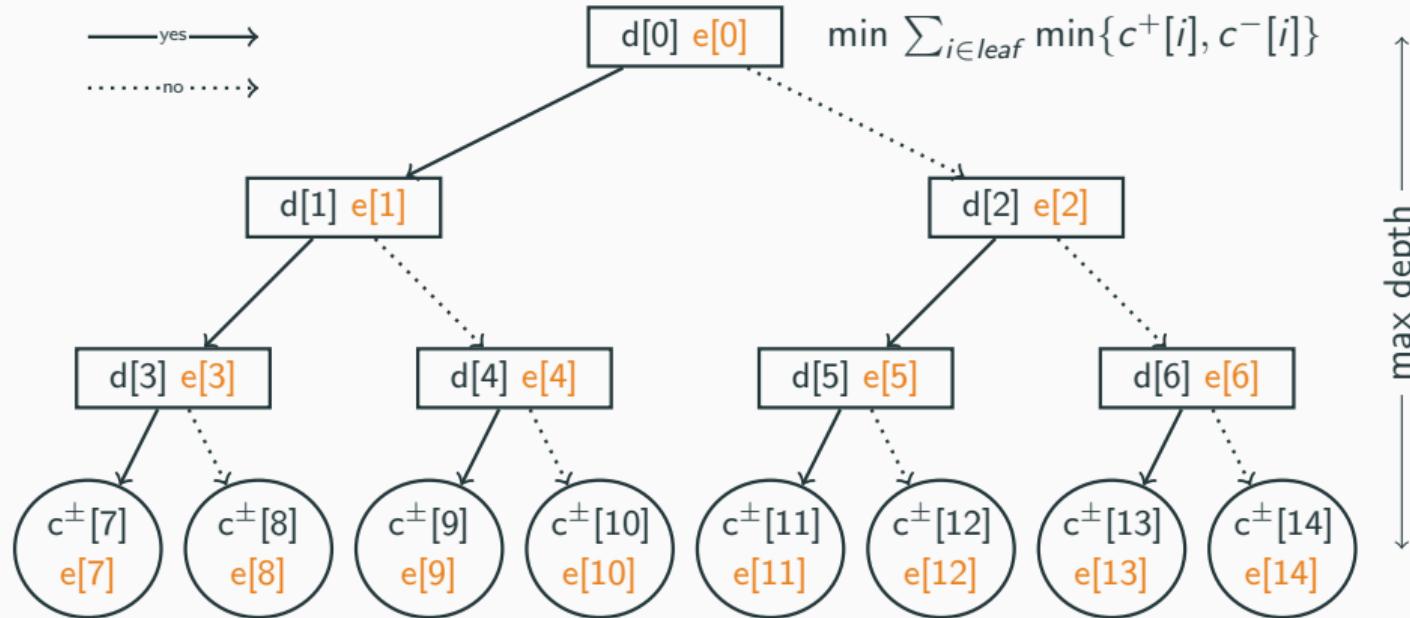


- redundant constraints improving speed



$$\text{dom}(d[i]) = \{0, 1, \dots, n\}$$

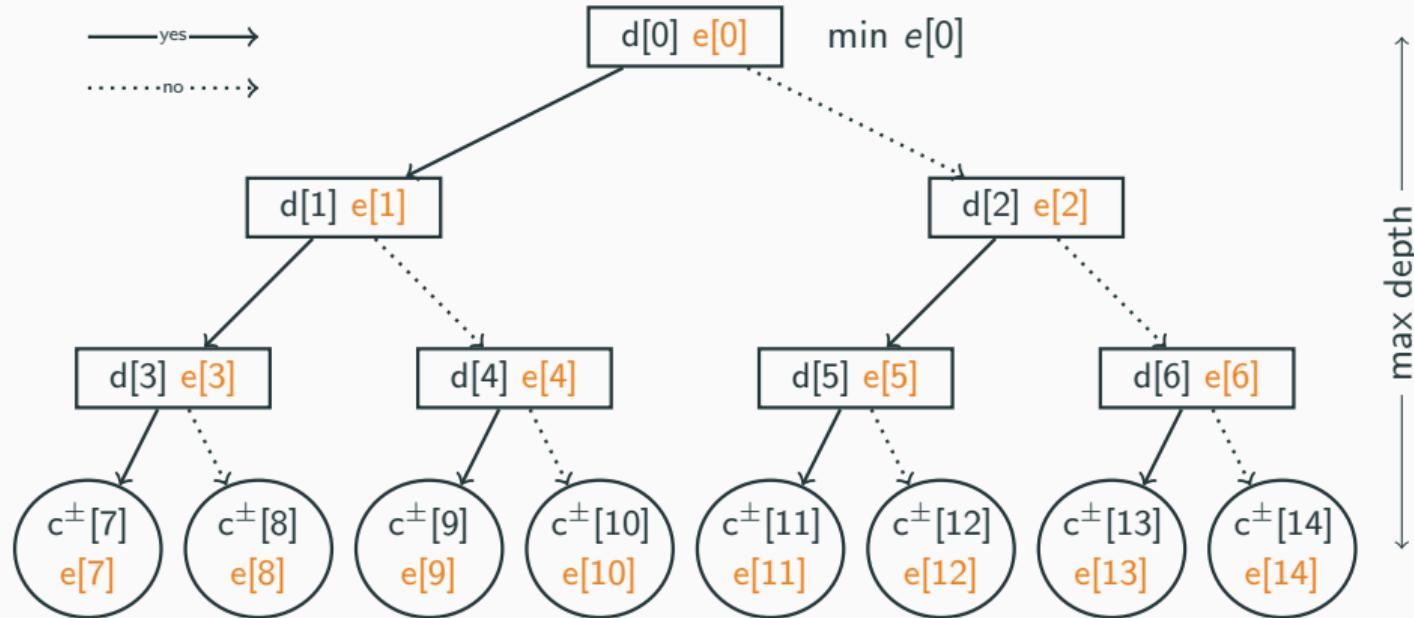
$$\text{dom}(c[i]) = \{0, \dots, N\}$$



$$\text{dom}(d[i]) = \{0, 1, \dots, n\}$$

$$\text{dom}(c[i]) = \{0, \dots, N\}$$

$$\text{dom}(e[i]) = \{0, \dots, N\}$$



$$\text{dom}(d[i]) = \{0, 1, \dots, n\}$$

$$\text{dom}(c[i]) = \{0, \dots, N\}$$

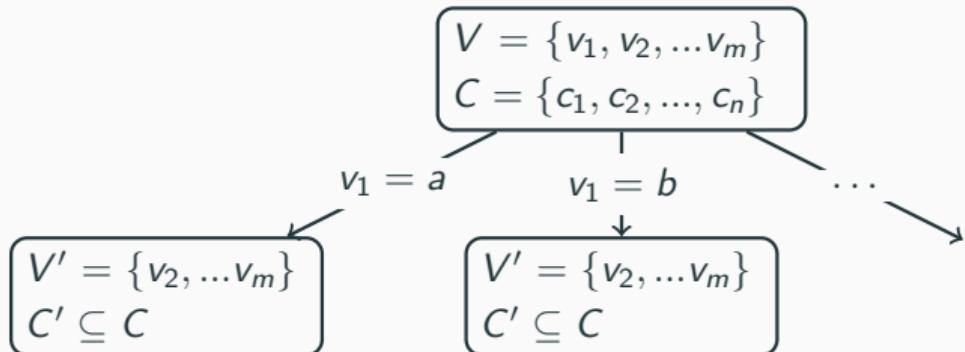
$$\text{dom}(e[i]) = \{0, \dots, N\}$$

Search

$$V = \{v_1, v_2, \dots, v_m\}$$
$$C = \{c_1, c_2, \dots, c_n\}$$

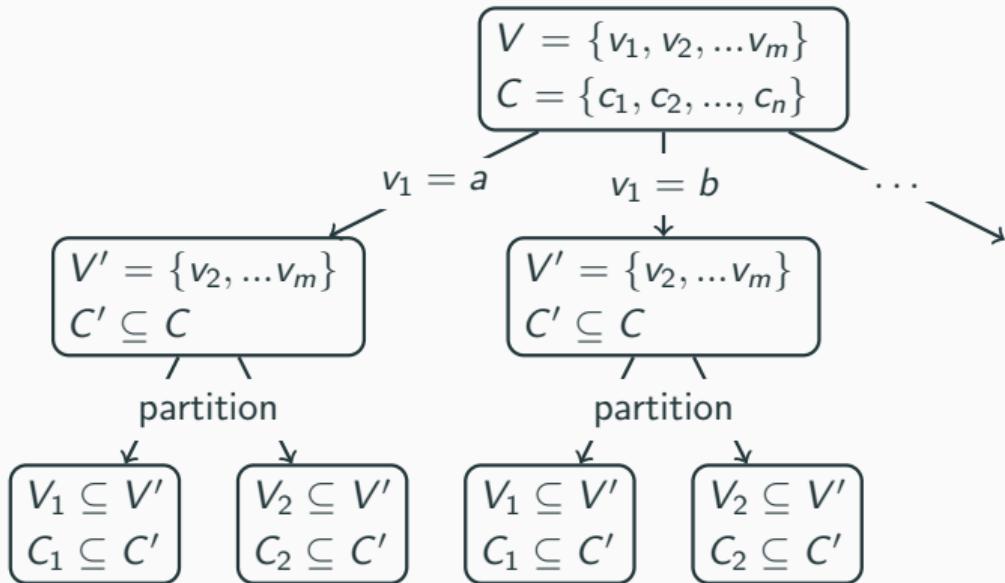
OR nodes

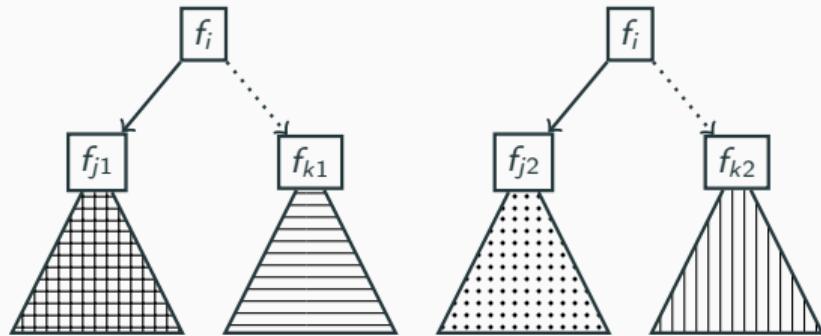
SOL = SOL₁ or SOL₂ or ...

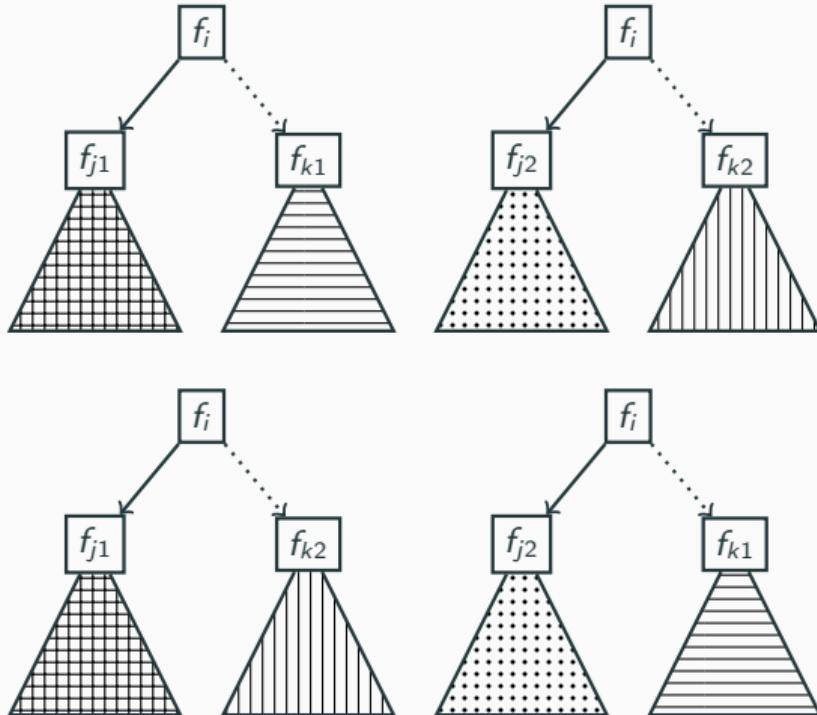


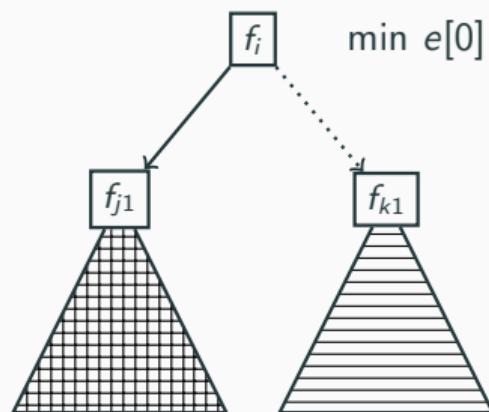
OR nodes

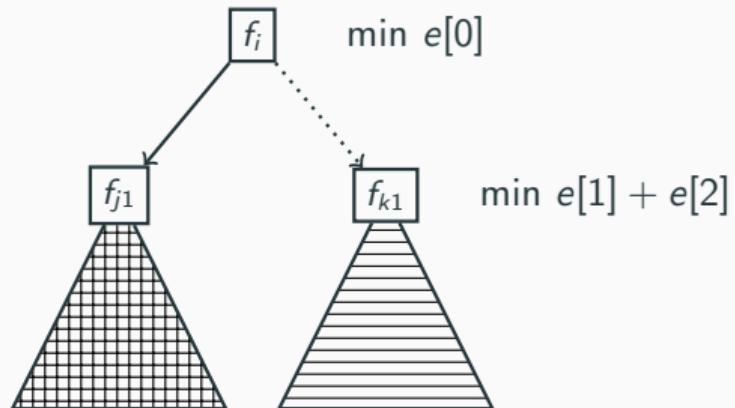
$SOL = SOL_1 \text{ or } SOL_2 \text{ or } \dots$

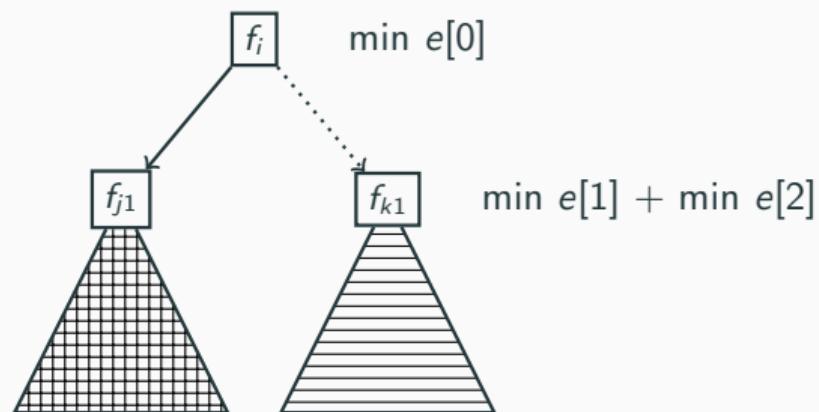
**OR nodes** $SOL = SOL_1 \text{ or } SOL_2 \text{ or } \dots$ **AND nodes** $SOL = SOL_1 \text{ and } SOL_2 \text{ and } \dots$

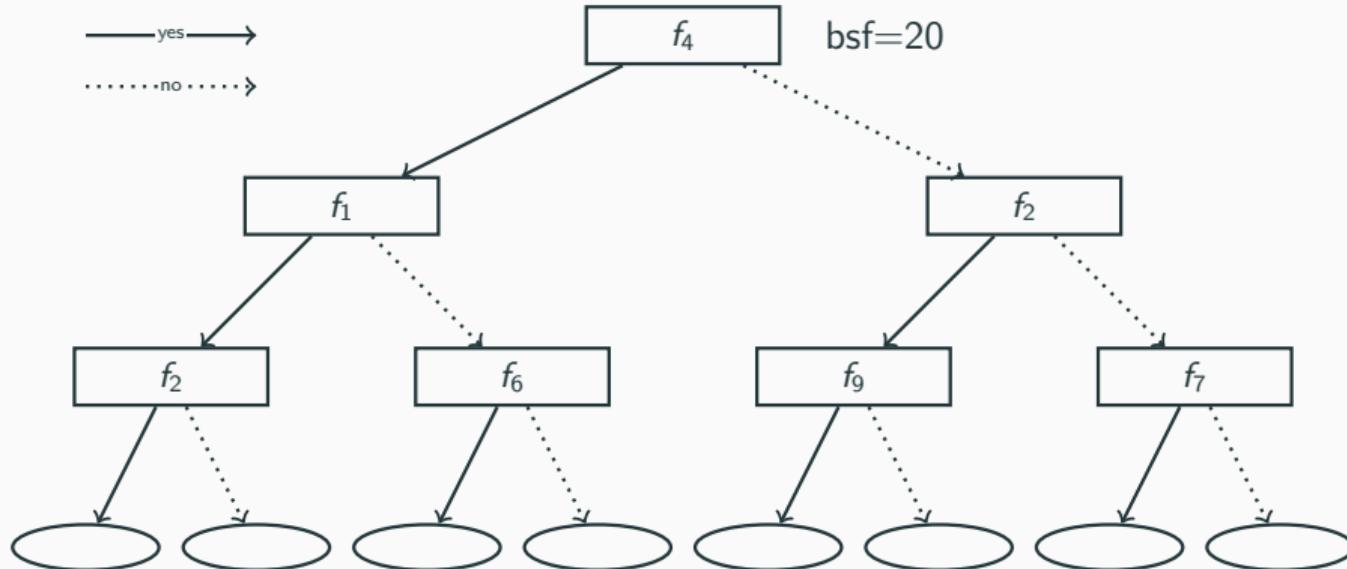


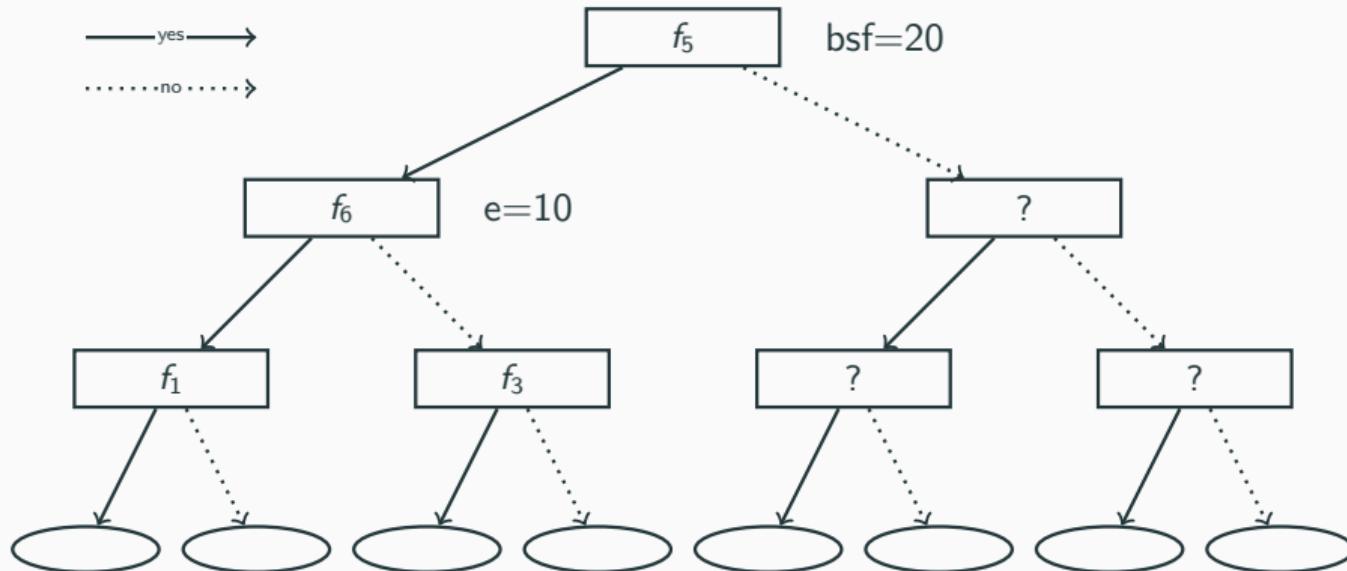


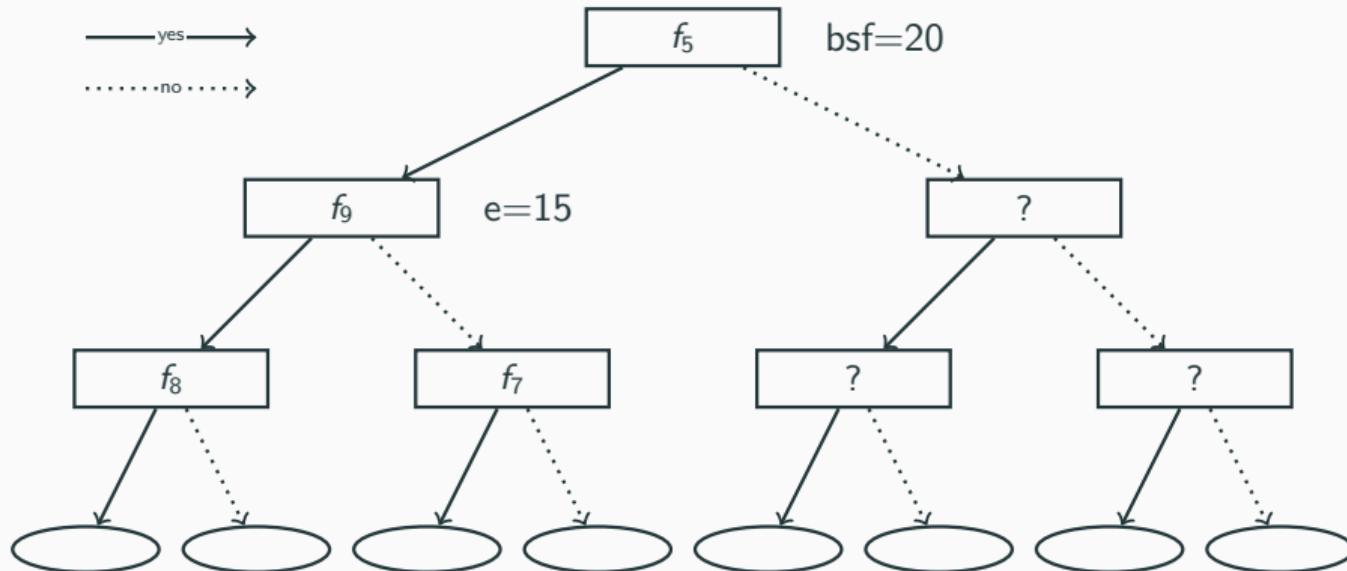


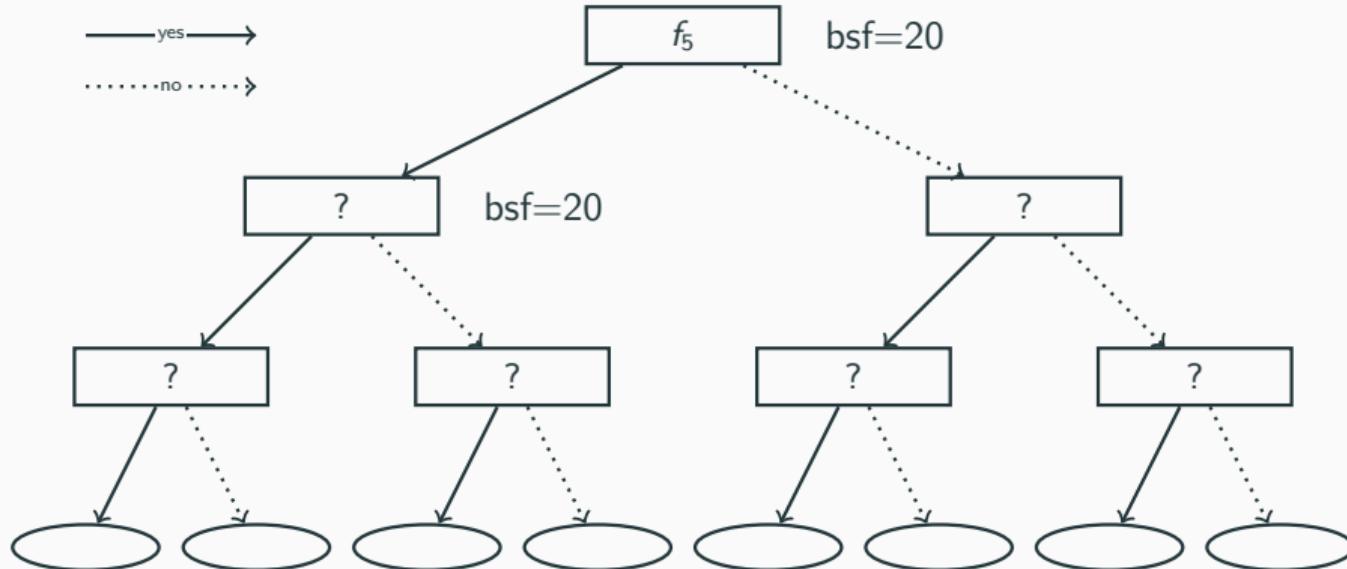


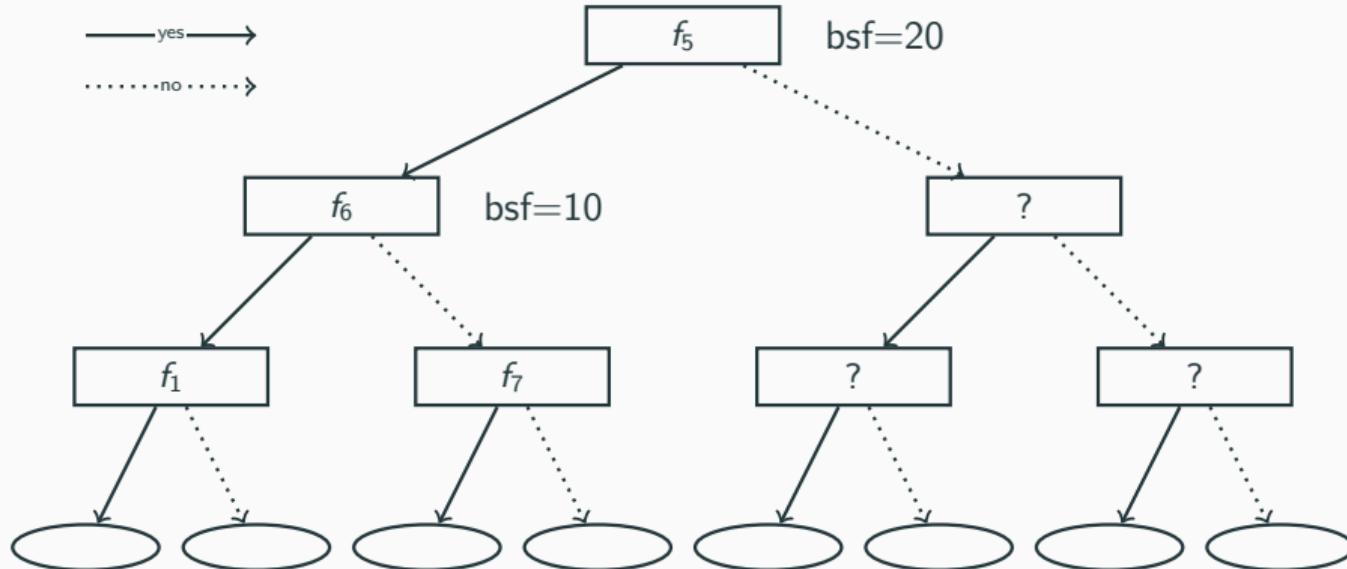


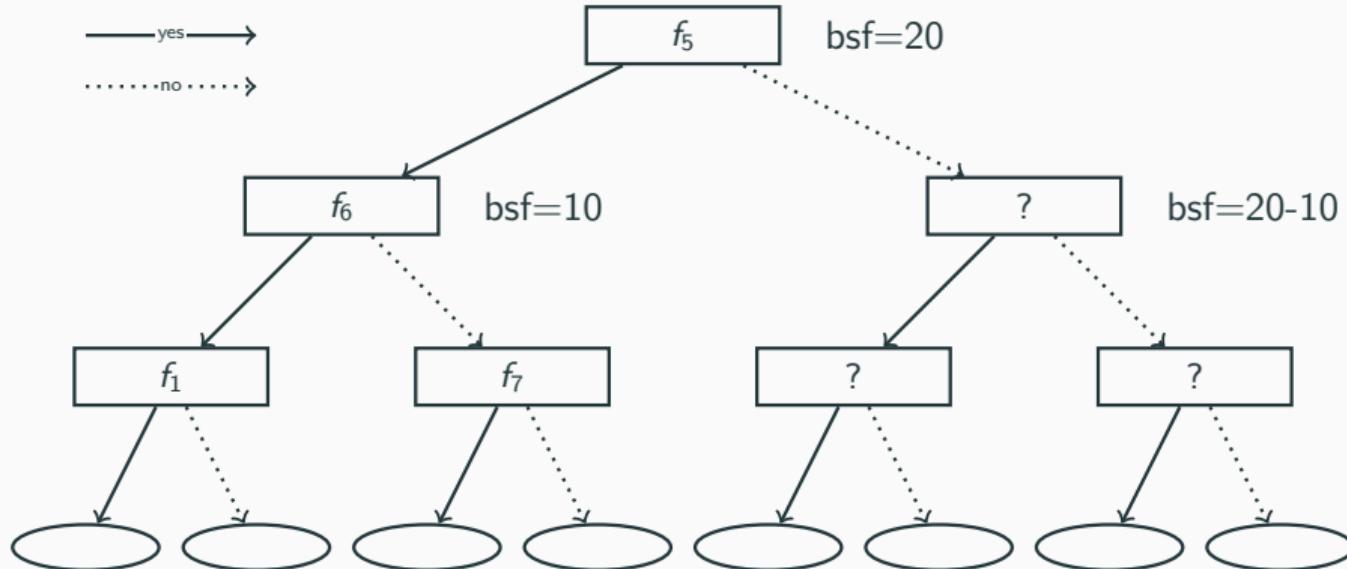


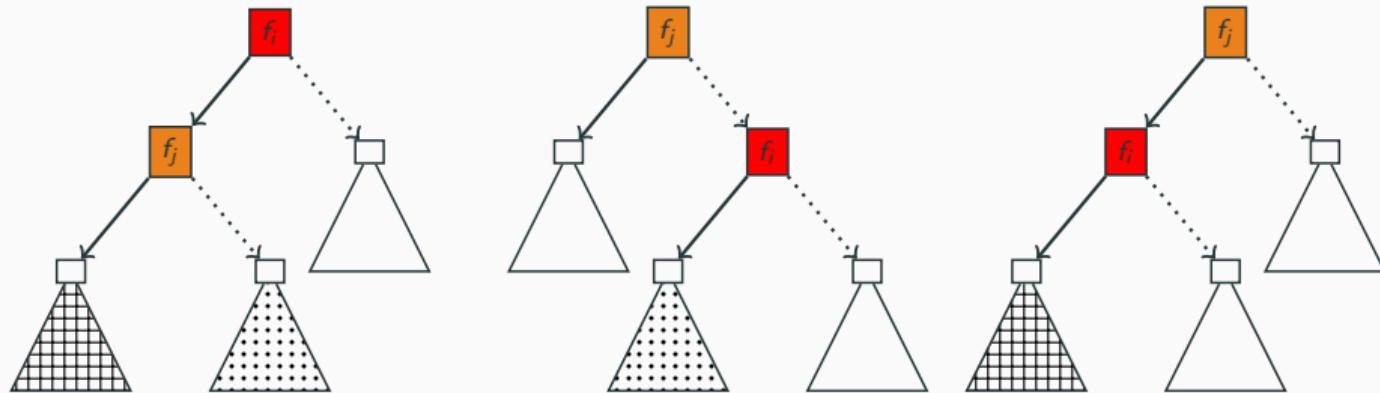


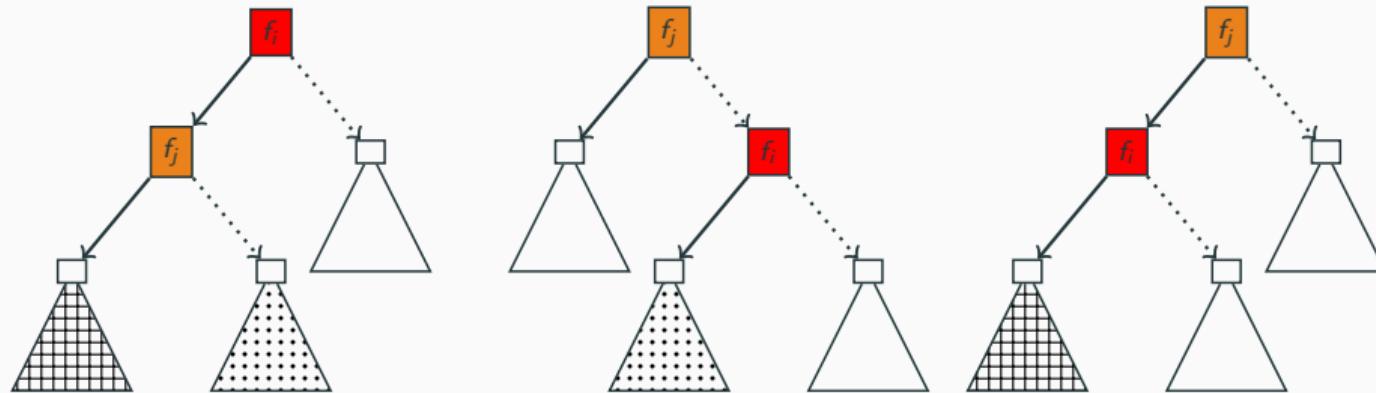












	yes	no	hash
	f_i f_j		$f_i, f_j -$
	f_i	f_j	$f_i - f_j$

Results

	$N_{\min} = 1$			$N_{\min} = 5$			
	DL8	BinOCT	CP	DL8	CP	CP-c	CP-m
Proven optimality	49(61%)	13(16%)	68 (85%)	54(67%)	65 (81%)	63(79%)	59(74%)
Best solution found	49(61%)	21(26%)	80 (100%)	54(67%)	79 (99%)	77(96%)	72(90%)
Fastest	17(21%)	1(1%)	63 (79%)	26(32%)	52 (65%)	36(45%)	27(34%)
Time out	31(39%)	67(84%)	12 (15%)	25(31%)	15 (19%)	17(21%)	21(26%)

23 instances, depths from 2 to 5, 10 min TO

DL8: Dynamic programming approach using frequent itemsets mining

BinOCT: MIP-based approach running on CPLEX

To summarize

- efficient method
- cp based
- exploits the structure of the problem
- anytime best solution

To go further

- multi-class decision trees
- continuous features through binarization
- other sum-based cost functions
- ...

And since...

And since...



The Thirty-Fourth AAAI Conference on Artificial Intelligence (AAAI-20)

Learning Optimal Decision Trees Using Caching Branch-and-Bound Search

Gaël Aglin, Siegfried Nijssen, Pierre Schaus

firstname.lastname@uclouvain.be

ICTEAM, UCLouvain
Louvain-la-Neuve, Belgium

Abstract

Several recent publications have studied the use of Mixed Integer Programming (MIP) for finding an optimal decision tree, that is, the best decision tree under formal requirements on accuracy, fairness or interpretability of the predictive model. These publications used MIP to deal with the hard computational challenge of finding such trees. In this paper, we introduce a new efficient algorithm, DL8.5, for finding optimal decision trees, based on the use of itemset mining

- the trees found are accurate while satisfying additional constraints such as on the *fairness* of the trees: in their predictions, the trees may favor one group of individuals over another.

With the increasing interest in explainable and fair models in machine learning, recent years have witnessed a renewed interest in alternative algorithms for learning decision trees that can provide such optimality guarantees.

Most attention has been given in recent years and in

Proceedings of the Twenty-Ninth International Joint Conference on Artificial Intelligence (IJCAI-20)

Learning Optimal Decision Trees with MaxSAT and its Integration in AdaBoost

Hao Hu^{1*}, Mohamed Siala¹, Emmanuel Hebrard¹, Marie-José Huguet¹

LAAS-CNRS, Université de Toulouse, CNRS, INSA, Toulouse, France¹

{hhu, siala, hebrard, huguet}@laas.fr

Abstract

Recently, several exact methods to compute decision trees have been introduced. On the one hand, these approaches can find optimal trees for vari-

methods might exist [Bennett, 1994]. Moreover, simpler (e.g. smaller) trees, are often more accurate on unknown data.

Recently, several exact methods have been introduced to find optimal decision trees for some combinations of criteria involving, their size (i.e., nodes), depth, and their empirical

Journal of Machine Learning Research 23 (2022) 1-47

Submitted 5/20; Revised 10/21; Published 2/22

MurTree: Optimal Decision Trees via Dynamic Programming and Search

Emir Demirović

Anna Lukina

*Delft University of Technology
Delft, The Netherlands*

E.DEMIROVIC@TUDELFT.NL

A.LUKINA@TUDELFT.NL

Emmanuel Hebrard

LAAS CNRS

Toulouse, France

HEBRARD@LAAS.FR

Jeffrey Chan

RMIT University

Melbourne, Australia

JEFFREY.CHAN@RMIT.EDU.AU

James Bailey

Christopher Leckie

Kotagiri Ramamohanarao

University of Melbourne

Melbourne, Australia

BAILEYJ@UNIMELB.EDU.AU

CALECKIE@UNIMELB.EDU.AU

KOTAGIRI@UNIMELB.EDU.AU

Peter J. Stuckey

Monash University and DATA61

Melbourne, Australia

PETER.STUCKEY@MONASH.EDU

Journal of Artificial Intelligence Research 80 (2024) 875-918

Submitted 01/2024; published 07/2024

SAT-based Decision Tree Learning for Large Data Sets

André Schidler

Stefan Szeider

Algorithms & Complexity,

TU Wien,

Favoritenstrasse 9-11,

1040 Vienna, Austria

ASCHIDLER@AC.TUWIEN.AC.AT

SZ@AC.TUWIEN.AC.AT

Abstract

Decision trees of low depth are beneficial for understanding and interpreting the data they represent. Unfortunately, finding a decision tree of lowest complexity (depth or size) that correctly represents given data is NP-hard. Hence known algorithms either (i) utilize heuristics that do not minimize the depth or (ii) are exact but scale only to small or medium-sized instances. We propose a new hybrid approach to decision tree learning, combining heuristic and exact methods in a novel way. More specifically, we employ SAT encodings repeatedly to local parts of a decision tree provided by a standard heuristic.

And many more...

Decision trees: from efficient prediction to responsible AI

H.Breuker, J.Dosovs, R.Ernest, D.Nefzaoui ... - *Frontiers in artificial ...*, 2023 - frontiersin.org
This article provides a birds-eye view on the role of decision trees in machine learning and data science over roughly four decades. It sketches the evolution of decision tree research ...
☆ Enregistrer 99 Citer Cité 145 fois Autres articles Les 11 versions 90

Machine learning in agriculture: A comprehensive updated review

L.Benos, A.C.Tsagarakis, G.Delis, R.Benito, D.Katsios ... - *Sensors*, 2021 - mdpi.com
The digital transformation of agriculture has evolved various aspects of management into artificial intelligent systems for the sake of making value from the ever-increasing data ...
☆ Enregistrer 99 Citer Cité 1002 fois Autres articles Les 15 versions 86

Mathematical optimization in classification and regression trees

E.Carrasco, C.Molero-Rio, D.Romero-Morales - *Top*, 2021 - Springer
Classification and regression trees, as well as their variants, are off-the-shelf methods in Machine Learning. In this paper, we review recent contributions within the Continuous ...
☆ Enregistrer 99 Citer Cité 178 fois Autres articles Les 15 versions 86

On tackling explanation redundancy in decision trees

Y.Izra, A.Savatev, J.Manes-Silva - *Journal of Artificial Intelligence ...*, 2022 - jair.org
Decision trees (DTs) epitomize the ideal of interpretability of machine learning (ML) models. The interpretability of decision trees motivates explainability approaches by so-called ...
☆ Enregistrer 99 Citer Cité 96 fois Autres articles Les 14 versions 66

Logic-based explainability in machine learning

J.Manes-Silva - ... Knowledge: 10th International Summer School 2022 ... , 2023 - Springer
The last decade witnessed an ever-increasing stream of successes in Machine Learning (ML). These successes offer clear evidence that ML is bound to become pervasive in a wide ...
☆ Enregistrer 99 Citer Cité 83 fois Autres articles Les 7 versions 66

Learning optimal decision trees using caching branch-and-bound search

G.Apolo, S.Nikolen, P.Schaus - *Proceedings of the AAAI conference on ...*, 2020 - ojs.aaai.org
Several recent publications have studied the use of Mixed Integer Programming (MIP) for finding an optimal decision tree, that is, the best decision tree under formal requirements on ...
☆ Enregistrer 99 Citer Cité 190 fois Autres articles Les 7 versions 66

On explaining decision trees

Y.Izra, A.Savatev, J.Manes-Silva - *arXiv preprint arXiv:2010.11034*, 2020 - arxiv.org
Decision trees (DTs) epitomize what have become to be known as interpretable machine learning (ML) models. This is informally motivated by paths in DTs being often much smaller ...
☆ Enregistrer 99 Citer Cité 144 fois Autres articles Les 8 versions 66

Murtree: Optimal decision trees via dynamic programming and search

E.Demirović, A.Lukina, E.Helman, J.Chen - ... - *Journal of Machine ...*, 2022 - jafr.org
Decision tree learning is a widely used approach in machine learning, favoured in applications that require concise and interpretable models. Heuristic methods are ...
☆ Enregistrer 99 Citer Cité 132 fois Autres articles Les 14 versions 66

SAT-based decision tree learning for large data sets

A.Schröder, S.Szeider - *Journal of Artificial Intelligence Research*, 2024 - jair.org
Decision trees of low depth are beneficial for understanding and interpreting the data they represent. Unfortunately, finding a decision tree of lowest complexity (depth or size) that ...
☆ Enregistrer 99 Citer Cité 79 fois Autres articles Les 13 versions 66

Constraint enforcement on decision trees: A survey

G.Nefzaoui, P.Terme, B.Fogarty - *ACM Computing Surveys (CSUR)*, 2022 - di.acm.org
Decision trees have the particularity of being machine learning models that are visually easy to interpret and understand. Therefore, they are primarily suited for sensitive domains like ...

And many more...

Decision trees: from

H Blockeel, L Dzeroski, B Pfahringer
Strong optimal classification trees

J Aghaei, A Görgen, P Vojtěchovský
This article provides a brief history of decision trees as among the most popular machine learning models and are used routinely in applications ranging from revenue management and medicine to bioinformatics. In this ...
☆ Enregisterer 99 Citer 6474 fois Autres articles Les 5 versions 00

Machine learning in

L Benos, AG Tsiagkis, G

The digital transformation of artificial intelligent systems

☆ Enregisterer 99 Citer

Mathematical optimi

E Carrasco, C Molero, R Ruiz
Optimal survival trees

Classification and regression Tree-based models are increasingly popular due to their ability to identify complex relationships that are beyond the scope of parametric models. Survival tree methods adapt ...
☆ Enregisterer 99 Citer 6464 fois Autres articles Les 9 versions 00

On tackling expla

Y Iizuka, A Srivastava, J Miettunen
Decision trees (DTs) depict

The interpretability of deep

☆ Enregisterer 99 Citer
Solid waste management techniques powered by in-silico approaches with a special focus on municipal solid waste management: Research trends and ...
S Vyas, K Dikhar, S Varani, RR Singhapakdi ... Science of The Total ... 2023 - Elsevier
Many technical, clinical, environmental, biological, financial, educational, and regulatory factors are typically involved in solid waste management (SWM). Artificial Intelligence (AI) ...
☆ Enregisterer 99 Citer 6416 fois Autres articles Les 7 versions 00

Logic-based explain

J Marques-Silva ... Know

The last decade witnessed the success of deep learning (ML). These successes of ...
☆ Enregisterer 99 Citer 00

Learning optimal de

G Agapi, S Nissen, P Schöls

Several recent publications finding an optimal decision tree ...
☆ Enregisterer 99 Citer

On explaining decis

Y Iizuka, A Srivastava, J Miettunen

Decision trees (DTs) depict learning (ML) models. This ...
☆ Enregisterer 99 Citer

Murtree: Optimal de

E Demirović, A Lukina, E

Decision tree learning is a ...
applications that require a ...
☆ Enregisterer 99 Citer

Optimal sparse regression trees

B Zhang, R Xin, M Jatkar, C Boden ... of the AAAI Conference on Artificial ... 2023 - ojs.aaai.org

A Schäfer, S Sezgin ... Int ... Regression trees are one of the oldest forms of AI models, and their predictions can be made without a calculator, which makes them broadly useful, particularly for high-stakes ...
☆ Enregisterer 99 Citer 6421 fois Autres articles Les 11 versions 00

MSLPNet: multi-scale location perception network for dental panoramic X-ray image segmentation

G Chen, Y Zhao, Y Liu, C Yang, P Li ... Neural Computing and ... 2021 - Springer

Tooth segmentation, as one of the key techniques of medical image segmentation, can be widely applied to various medical applications, e.g. orthodontic treatment, corpse ...
☆ Enregisterer 99 Citer 6443 fois Autres articles Les 5 versions 00

And many more...

Decision trees: from	Strong optimal classifiers
H.Bockelé, J.Dixit, S.Els...	J.Aghaei, A.Görner, P.Vesely
This article provides a brief	Q.Vas, S.Vermer - Proceedings of the AAAI Conference on Artificial ... - 2022 - ojs.aaai.org
data science overview roughly	Decision trees are among the
☆ Enregister 99 Citer 0	most popular machine learning models. They are widely applied in various fields such as
Machine learning in	Necessary and sufficient programming
L.Benos, A.C.Tsiagiris, G...	R.Nerfack
The digital transformation	Learn the London M&S stores
artificial intelligent systems	Global optimization of decision trees and consequently humans can ...
☆ Enregister 99 Citer 0	... be explained by decision trees. This paper proposes a tentative and original survey of meeting points between Knowledge Representation and Reasoning (KRR) and Machine Learning (ML), two areas which have ...
Mathematical optimi	Optimal survival trees
E.Carmossi, C.Molero, R.R...	Q.Beranek, J.Ban, E.Gib...
Classification and regress	Trees-based models are more
Machine Learning, In th	relationships that are beyond
☆ Enregister 99 Citer 0	the reach of decision trees. This paper presents a survey of the state-of-the-art in ...
On tackling expla	(mu) Solid waste man
Y.Izquierdo, A.Jarabo, J.Mor...	Optimal learning customized decision trees for domain-knowledge constraints
Decision trees (DTs) repre	Q.Vyas, K.Dhakar, S.Variani...
The interpretability of dec	Many technical, clinical, envi...
☆ Enregister 99 Citer 0	ctors are typically involved
Logic-based explain	Optimal survival trees: Witby: An efficient solver for computing minimum-size decision trees
J.Marcos-Silva, V.Koen...	T.Huisman, J.M.van der Lin...
The last decade witnessed	LP.Blaauw, C.Konvalinka, F.Schmerl ... - Proceedings of the AAAI ... - 2025 - ojs.aaai.org
(ML). These successes of	Survival analysis studies and
☆ Enregister 99 Citer 0	based on historical data, whi...
Learning optimal de	Optimal tree policies for Markov decision processes
G.Agrün, S.Nissen, P.Sch...	M.Amaroo, J.Duro, Y.D.Zhai...
Several recent publications	We propose an approach for
finding an optimal decis	data, combining methods for
☆ Enregister 99 Citer 0	learning such interpretable policies as rule-based policies such as ...
On explaining decis	(por) Learning optimal i
Y.Izquierdo, A.Jarabo, J.Mor...	PyDlib. 5: a library for learning optimal decision trees
Decision trees (DTs) repres	H.Hu, M.Ralle, E.Hancock, M...
learning (ML) models. Thi	Recently, several exact meth...
☆ Enregister 99 Citer 0	oach, this approaches
Murtree: Optimal de	(por) Model tree modell
E.Demirovic, A.Lukina, E.J...	Optimal or greedy decision trees? revisiting their objectives, tuning, and
Decision tree learning is a	real-time adaptive appli...
applications that require e	performance
☆ Enregister 99 Citer 0	J.G.M.van der Linde, D.Vos, MM.de Weerdt ... - arXiv preprint arXiv ... - 2024 - arxiv.org
SAT-based decision	(por) Optimal sparse regre
A.Schröder, S.Szeder, J.m...	Regression trees are one of
Decision trees of low-dep	made without a calculator, w...
represent. Unfortunately, w	... decision trees. Empirical research has shown that optimal trees typically have better out-of-...
☆ Enregister 99 Citer 0	sample performance than tr...
Constraint enforc	MSLPNet: multi-scale image segmentation
G.Nerfack, P.Terrade, B.F...	Q.Chen, Y.Zhao, Y.Liu, Z.X...
Decision trees have the p	Tooth segmentation, as one c...
to interpret and understan	widely applied to various met...
☆ Enregister 99 Citer 0	ods. MSLPNet is a neural netwo...
Optimization over tra	Optimal multivariate decision trees
B.Zhao, R.Xin, M.Satish, G...	J.Boulanger, C.Michalek, Z.Zgusta - Constraints, 2023 - Springer
Optimization over tra	Recently, mixed-integer programming (MIP) techniques have been applied to learn optimal
ained neural networks for	decision trees. Empirical research has shown that optimal trees typically have better out-of-...
Decision trees have the p	sample performance than tr...
to interpret and understan	sample performance than tr...
☆ Enregister 99 Citer 0	ods. MSLPNet is a neural netwo...
MSLPNet: multi-scale	Optimization over trained neural networks: Taking a relaxing walk
image segmentation	Tong, J., Gai, T.Serra - International Conference on the Integration of ... - 2024 - Springer
Constrain enforce	Besides training, mathematical optimization is also used in deep learning to model and
G.Nerfack, P.Terrade, B.F...	guide formulation over-trained neural networks for purposes such as verification ...
Decision trees have the p	... and thus improve the quality of the generated solutions.
to interpret and understan	☆ Enregister 99 Citer 0
☆ Enregister 99 Citer 0	Autres articles Les 2 versions 00

And many more...

Decision trees: from H.Blockeel, J.Dzeroski, B.Fayyad, A.Gómez, P.Vanherle This article provides a brief history of decision trees and highlights their applications ranging from rule induction to adversarial learning.	Strong optimal classifier Q.Vas, S.Verma - Proceedings of the AAAI conference on ... 2024 - AAAI.org
Machine learning in L.Berens, A.C.Tzengakis, G.Kontaxis The digital transformation of intelligent systems ☆ Enregister 89 Citer 0	Robust optimal classifier Q.Vas, S.Verma - Proceedings of the AAAI conference on ... 2024 - AAAI.org
Necessary and sufficient programming L.Jones, M.Jones Global optimization of decision trees and consequently human-computer synergies	An improved column-generation-based matheuristic for learning classification trees H.K.Patel, G.Desaulniers, A.Lodi - Computers & Operations Research, 2024 - Elsevier
Mathematical optimi E.Carrasco, C.Molero, R.Rodríguez Classification and regression Machine Learning, In this issue ☆ Enregister 89 Citer 0	Decision trees are a popular model for solving classification problems in machine learning (ML). The standard ML algorithms for training decision trees are fast but generate ... ☆ Enregister 89 Citer 0
On tackling expla Y.Izquierdo, A.Ratnaveet, J.M.López Decision trees (DTs) explainability The interpretability of decisions ☆ Enregister 89 Citer 0	Synergies between machine learning and AI R.Amel group L.Jones, M.Jones Global optimization of decision trees and consequently human-computer synergies
Optimal survival trees Q.Beranek, J.Dzeroski, E.Gómez Tree-based models are now widely used in medical applications to predict survival times and relationships that are beyond the reach of traditional statistical methods.	Optimal decision trees for nonlinear metrics J.Yu, A.Hanley, P.J.Stedinger Decision sets are a central component of machine learning models. Given the increased complexity of real-world data, it is often necessary to evaluate the performance of machine learning models, in ...
Logic-based explai J.Marcos-Silva, ... The last decade witnessed the success of machine learning (ML). These successes of ML have led to a special focus on explaining its decisions.	Learning optimal decision trees: an optimal dynamic programming approach J.Yu, A.Hanley, P.J.Stedinger Regression trees are a human-comprehensible machine-learning model that can represent complex relationships. They are typically trained using greedy heuristics because computing ...
Optimal survival trees Q.Beranek, J.Dzeroski, E.Gómez Tree-based models are now widely used in medical applications to predict survival times and relationships that are beyond the reach of traditional statistical methods.	Optimal constant and linear regression trees: an optimal dynamic programming approach M.Van Den Bos, J.G.M.Van Der Linde, ... - Forty-first International ... 2024 - openreview.net
Optimal decision tree M.Aman, J.Dzeroski, Y.Zhang We propose an approach for data, combining methods for learning interpretable trees with historical data, while maintaining interpretability and generalization.	Regression trees are a human-comprehensible machine-learning model that can represent complex relationships. They are typically trained using greedy heuristics because computing ... ☆ Enregister 89 Citer 0
Optimal decision tree H.Hu, M.Ralla, E.Holczer, M.Yu, Z.Zhao Recently, several exact methods have been proposed for learning interpretable decision trees. These approaches are based on historical data, while maintaining interpretability and generalization.	Optimal decision trees with explicit paths T.Huusken, J.M.J. van der Lijn, C.Konstantinos, E.J.J. den Hollander - Intermediate conference on theory and applications ... 2020 - Springer
Optimal decision tree H.Hu, M.Ralla, E.Holczer, M.Yu, Z.Zhao Recently, several exact methods have been proposed for learning interpretable decision trees. These approaches are based on historical data, while maintaining interpretability and generalization.	Optimal decision trees are a classic model for classification. Decision trees play an important role both in Machine Learning and Knowledge Representation. They are attractive due to their immediate interpretability. In the spirit of ... ☆ Enregister 89 Citer 0
On explaining decis Y.Izquierdo, A.Ratnaveet, J.M.López Decision trees (DTs) explainability learning (ML) models. This paper presents a SAT-based approach for learning optimal decision trees with explicit paths.	SAT-based encodings for optimal decision trees with explicit paths H.Jiménez, J.Morales - Intermediate conference on theory and applications ... 2020 - Springer
Optimal decision tree H.Hu, M.Ralla, E.Holczer, M.Yu, Z.Zhao Recently, several exact methods have been proposed for learning interpretable decision trees. These approaches are based on historical data, while maintaining interpretability and generalization.	Optimal decision diagrams for classification Q.Vas, S.Verma - arXiv preprint arXiv:2309.08007
Optimal decision tree H.Hu, M.Ralla, E.Holczer, M.Yu, Z.Zhao Recently, several exact methods have been proposed for learning interpretable decision trees. These approaches are based on historical data, while maintaining interpretability and generalization.	Decision diagrams for classification have some notable advantages over decision trees, as their internal connections can be determined at training time and their width is not bound to ... ☆ Enregister 89 Citer 0
Optimal decision tree H.Hu, M.Ralla, E.Holczer, M.Yu, Z.Zhao Recently, several exact methods have been proposed for learning interpretable decision trees. These approaches are based on historical data, while maintaining interpretability and generalization.	SAT-based optimal classification trees for non-binary data P.Shati, F.Cohen, S.Mohajer - Constraints, 2023 - Springer
Optimal decision tree H.Hu, M.Ralla, E.Holczer, M.Yu, Z.Zhao Recently, several exact methods have been proposed for learning interpretable decision trees. These approaches are based on historical data, while maintaining interpretability and generalization.	Decision trees are a popular classification model in machine learning due to their interpretability and performance. Traditionally, decision-tree classifiers are constructed using ... ☆ Enregister 89 Citer 0
Murtree: Optimal de E.Demirović, A.Lukina, E.J.J. den Hollander Decision tree learning is a powerful tool for solving classification problems. However, it is difficult to interpret the decisions of a decision tree. This paper proposes a SAT-based approach for learning optimal decision trees with explicit paths.	Optimal decision tree performance H.Hu, M.Ralla, E.Holczer, M.Yu, Z.Zhao Recently, several exact methods have been proposed for learning interpretable decision trees. These approaches are based on historical data, while maintaining interpretability and generalization.
Optimal sparse regress Q.Zhao, R.Xin, M.Soltani, ... - arXiv preprint arXiv:2309.08007	SAT-based approach for learning optimal decision trees with non-binary features P.Shati, F.Cohen, S.Mohajer - 27th International Conference on ... 2021 - drops.dagstuhl.de
SAT-based decision A.Schröder, P.Tzortzis, I.-Jin Decision trees of low depth represent. Unfortunately, they are not always accurate enough.	Decision trees are a popular classification model in machine learning due to their interpretability and performance. Traditionally, decision-tree classifiers are constructed using ... ☆ Enregister 89 Citer 0
Constraint enforc Q.Nefarza, P.Tzortzis, B.Fayyad Decision trees have the potential to interpret and understand	SAT-based approach for learning optimal decision trees with non-binary features P.Shati, F.Cohen, S.Mohajer - 27th International Conference on ... 2021 - drops.dagstuhl.de
MSLPNet: multi-scale image segmentation Q.Chen, Y.Zhao, Y.Liu, Y.Zhu Tooth segmentation, as one of the most challenging tasks in dental image analysis, has been widely applied to various medical applications.	Optimization over trees: Strong max-flow formulations S.Saberi, A.Gómez, P.Vanherle - arXiv preprint arXiv:2002.09142, 2020 - arxiv.org
Optimization over trees: Strong max-flow formulations S.Saberi, A.Gómez, P.Vanherle - arXiv preprint arXiv:2002.09142	We consider the problem of learning optimal binary classification trees. Literature on the topic has burgeoned in recent years, motivated both by the empirical superiority of ... ☆ Enregister 89 Citer 0
Constrain enforce Q.Nefarza, P.Tzortzis, B.Fayyad Decision trees have the potential to interpret and understand	Optimization over trees: Strong max-flow formulations S.Saberi, A.Gómez, P.Vanherle - arXiv preprint arXiv:2002.09142

And many more...

Decision trees: from H.Blockeel, J.Dzeroski, S.Fa This article provides a brief data science overview roughly ☆ Enregister 99 Citer 0	Strong optimal classif A.Gómez, A.Gómez, P.Varela Decision trees are among the most popular machine learning models. Decision trees have the ability to handle both categorical and numerical data types. ☆ Enregister 99 Citer 0	Reasoning-based learning of interpretable ML models A.Jayadev, J.Marcos-Silva, ... - Joint Conference on ..., 2021 - research.monash.edu Artificial Intelligence (AI) is widely used in decision making procedures in myriad of real-world applications across important practical areas such as finance, healthcare, education ... ☆ Enregister 99 Citer 0 Cité 29 fois Autres articles Les 5 versions 99
Machine learning in L.Berces, A.C.Tezeloglu, G. The digital transformation of intelligent systems ☆ Enregister 99 Citer 0	Necessary and suffic programming R.Amel group Loes den Londen, M.de Zeeuw Global optimization of decision trees and consequently human Representation and Reason ☆ Enregister 99 Citer 0	Synergies between mu Optimal decision trees J.Yu, A.Hastie, P.J.Schoenberg Tree-based models are now relationships that are beyond the limits of traditional Regression trees are a more complex relationships. They i ☆ Enregister 99 Citer 0
Mathematical optimi E.Carrasco, C.Molero-Ru Classification and regress Machine Learning, In the ☆ Enregister 99 Citer 0	Optimal survival trees D.Bertaccini, J.Bian, F.Bigaz Tree-based models are now relationships that are beyond the limits of traditional Regression trees are a more complex relationships. They i ☆ Enregister 99 Citer 0	Optimal decision trees Piecewise constant an learning approach J.Yu, A.Hastie, P.J.Schoenberg Decision trees are a classic f models. Given the selection o Regression trees are a more complex relationships. They i ☆ Enregister 99 Citer 0
On tackling expla Y.Izquierdo, A.Rodríguez, J.Mor Decision trees (DTs) expla The interpretability of dec ☆ Enregister 99 Citer 0	Learning optimal decis D.Bertaccini, J.Bian, F.Bigaz Tree-based models are now relationships that are beyond the limits of traditional Regression trees are a more complex relationships. They i ☆ Enregister 99 Citer 0	Optimal Classification Trees for Continuous Feature Data Using Dynamic Programming with Branch-and-Bound C.E.Brito, JGM van der Linde CE.Brito, JGM van der Linde - Proceedings of the AAAI ..., 2025 - aaai.org Computing an optimal classification tree that provably maximizes training performance within a given size limit, is NP-hard, and, in practice, most state-of-the-art methods do not ... ☆ Enregister 99 Citer 0 Cité 2 fois Autres articles Les 4 versions 99
Logic-based explain J.Marcos-Silva, ... - Know The last decade witness (ML). These successes of ☆ Enregister 99 Citer 0	Optimal survival trees: Witt, An efficient solu T.Huisman, JGM van der Lin LP Staelin, C.Konstantinos, E Survival analysis studies and based on historical data, whil ☆ Enregister 99 Citer 0	Optimal classification trees with leaf-branch and binary constraints E.Ilie, T.Hu, T.Tan, C.Hanafi - Computer & Operations Research, 2024 - elsevier Using empirical models to predict whether sections within pipes have defects can save inspection costs and, potentially, avoid oil spills. Optimal Classification Tree (OCT) ... ☆ Enregister 99 Citer 0 Cité 4 fois Autres articles Les 2 versions 99
Learning optimal decis G.Agrün, S.Nissen, P.Schä Several recent papers finding an optimal decis ☆ Enregister 99 Citer 0	Optimal decision trees M.Amorim, J.Duarte, Y.D.Zha We propose an approach for data, combining methods for learning such interpretab ☆ Enregister 99 Citer 0	Harnessing the power of choices in decision tree learning G.Bianchi, J.Larose, C.Patterson, ... - Advances in ..., 2023 - proceedings.neurips.cc T.Huisman, JGM van der Linde, J.Marcos-Silva, ... - Advances in ..., 2023 - proceedings.neurips.cc Decision trees are a classic f interpretability and general representation. They are attr ☆ Enregister 99 Citer 0
On explaining decis Y.Izquierdo, A.Rodríguez, J.Mor Decision trees (DTs) expla learning (ML) models. Th ☆ Enregister 99 Citer 0	Optimal decision diag J.Vos, S.Verma, ... - arXiv prepr Interpretability of reinforcement Decision diagrams for classif their internal connections c ☆ Enregister 99 Citer 0	Optimizing binary decision diagrams with maxsat for classification H.Hu, M.Juguet, M.Sala - Proceedings of the AAAI Conference on ..., 2022 - ojs.aaai.org The growing interest in explainable artificial intelligence (XAI) for critical decision making motivates the need for interpretable machine learning (ML) models. In fact, due to their ... ☆ Enregister 99 Citer 0 Cité 20 fois Autres articles Les 10 versions 99
Murtree: Optimal de E.Demirovic, E.Hetzler, E.J Decision tree learning is applications that require a ☆ Enregister 99 Citer 0	PyDiB: 5: a library H.Hu, M.Sala, E.Hetzler, M Recently, several exact meth One needs, these approaches ☆ Enregister 99 Citer 0	SAT-based optimal clas P.Shah, F.Cohen, S.Mohant Decision trees are a popular i interpretability and performa ☆ Enregister 99 Citer 0
SAT-based decision A.Schröder, P.Tennete, J.m Decision trees of low depth represent. Unfortunately, t ☆ Enregister 99 Citer 0	PyDiB: 5: a library H.Hu, M.Sala, E.Hetzler, M Recently, several exact meth One needs, these approaches ☆ Enregister 99 Citer 0	PyDiB: 5: a library H.Hu, M.Sala, E.Hetzler, M Recently, several exact meth One needs, these approaches ☆ Enregister 99 Citer 0
Constraint enforc G.Nefkak, P.Tennete, B.F Decision trees have the p to interpret and understand ☆ Enregister 99 Citer 0	Optimal sparse regress B.Zhang, R.Xin, M.Soldani, J.m Regression trees are one of the most widely used classifiers, w Decision trees, Empirical rese ☆ Enregister 99 Citer 0	Learning optimal class A.Gómez, A.Gómez, P.Varela We consider the problem of the topic has burgeoned in recent decades, mixed-integer progr Decision trees. Empirical rese ☆ Enregister 99 Citer 0
MSLPNet: multi-class image segmentation G.Nefkak, P.Tennete, B.F Decision trees have the p to interpret and understand ☆ Enregister 99 Citer 0	Optimization over trai Z.Liu, W.Teng, B.Gao, Y.Huang Medical panoramic X-ray imag has become a widely used d Decision trees. Empirical rese ☆ Enregister 99 Citer 0	Adapting SAMD 1 Tong, J.Gómez, T.Serra - Internat Optimal Panoramic X-R Besides training, mathematical data formulation over train ☆ Enregister 99 Citer 0
Shattering inequalitie E.Demirovic, H.Jean, ... - Conference on Machine ..., 2023 - proceedings.mlprom... We propose a simple algorithm to learn optimal decision trees of bounded depth. This algorithm is essentially an anytime version of the state-of-the-art dynamic programming ... ☆ Enregister 99 Citer 0 Cité 15 fois Autres articles Les 6 versions 99	Optimization over tra Z.Liu, W.Teng, B.Gao, Y.Huang Medical panoramic X-ray imag has become a widely used d Decision trees. Empirical rese ☆ Enregister 99 Citer 0	Shattering inequalitie E.Demirovic, H.Jean, ... - Conference on Machine ..., 2023 - proceedings.mlprom... We propose a simple algorithm to learn optimal decision trees of bounded depth. This algorithm is essentially an anytime version of the state-of-the-art dynamic programming ... ☆ Enregister 99 Citer 0 Cité 15 fois Autres articles Les 6 versions 99

And many more...

Decision trees: from H. Blockeel, J. Dzeroski, B. Faloutsos, A. Goerdt, P. Vreeken This article provides a brief data science overview roughly 10 years old.	Strong optimal classifier Q.Vas, S.Verma - Proc. ICDM Decision trees are among the most widely used classifiers in applications ranging from 10 years old.	Robust optimal classifier H.K. Patel, G. Deshpande, A.Lu Decision trees are a popular classifier for adversarial settings.	An improved classification tree A.Jayatissa, J. Marques-Silva Decision trees are highly interpretable, but suffer from adversarial robustness.	Reasoning-based learning A.Jayatissa, J. Marques-Silva Artificial Intelligence (AI) is a world application across in fields, attracting increasing interest and explosion in contemporary research and practice.
Machine learning in L.Benito, A.C. Teixeira, G. Tadevosyan The digital transformation of intelligent systems.	Necessary and sufficient programming L.J. Benito, M. da Silva, G. Tadevosyan Global optimization of decision trees and consequently human-computer synergies.	Synergies between machine learning and AI J. Benito, Z. Borsigova, A. Cerny, P. Demirov, P.J. Stoev This paper proposes a textual representation of Reasons and Reasons index, often used in machine learning.	Optimal decision trees Y.Jia, A.Jayatissa, P.J. Stoev Decision trees are a special case of piecewise constant functions.	On optimal regression trees to detect critical intervals for multivariate functional data R.Banerjee, E.Carriou, C.Makoto-Ryu In this paper, we talk optimal randomized regression trees to handle multivariate functional data. A compromise between prediction accuracy and sparsity is sought, whilst fitting the ...
Mathematical optimisation in E.Carrasco, C. Molero-Ryu Classification and regression Machine Learning, In this paper, we propose a textual representation of Reasons and Reasons index, often used in machine learning.	Optimal survival trees E.Carrasco, J.Dam, C.Gómez Tree-based models are now widely used to model relationships that are beyond linear.	Learning optimal decision trees Y.Jia, A.Jayatissa, P.J. Stoev Decision sets are the decisions made by a machine learning system.	Piecewise constant programming approach Y.Jia, A.Jayatissa, P.J. Stoev Decision sets are the decisions made by a machine learning system.	Precisely precise, succinct and efficient explanations for decision trees Y.Jia, A.Jayatissa, N.Mesrobian, M.C. Cosser Decision trees (DTs) embody interpretable classifiers. DTs have been advocated for deployment in high-risk applicatons, but also for explaining other complex classifiers.
On tackling explainability Y.Jia, A.Jayatissa, J.M. Li Decision trees (DTs) explainability The interpretability of decision trees is often a key factor in their success.	Solid waste management S.Vyas, K. Dhaker, S. Venkateswaran, D. Prasad Many technical, clinical, environmental factors are typically involved.	Learning small decision trees Y.Jia, A.Jayatissa, P.J. Stoev One feature decision trees are often used for interpretability. However, they are often large and complex.	Optimal classification programming with Br.E.Carrasco, J.Dam, J.M. Li Computing an optimal classification tree with a given size limit, it is a complex relationship.	Interpretable decision trees through MaxSAT E.Jia, T.Hu, T.Zhang, C.Hu We present an approach to improve the accuracy-interpretability trade-off of Machine Learning (ML) Decision Trees (DTs). In particular, we apply Maximum Satisfiability ...
Logic-based explainability J. Marques-Silva, ... H. Blockeel, J. Dzeroski, B. Faloutsos, A. Goerdt, P. Vreeken The last decade witnessed the success of machine learning (ML). These successes of ML have led to the need for explainability.	Optimal survival trees H. Blockeel, J. Dzeroski, B. Faloutsos, A. Goerdt, P. Vreeken Survival analysis studies and models based on historical data, while being interpretable, have been ...	Optimal decision trees M. Amrani, J. Dzeroski, Y.D. Zhani We propose an approach for data, combining methods for learning such interpretable DTs.	SAT-based encodings J. Marques-Silva, A. Goerdt, P. Vreeken Decision trees play an important role in many applications. They are often used for interpretability and generalization.	Harnessing: A decision tree induction method based on recursive optimal boolean rule composition Q. Blanuša, J. Llana, C. Patrino We propose a simple generic learning algorithm such as ...
Learning optimal decision trees H. Blockeel, S. Nijssen, P. Schuurmans Several recent approaches finding an optimal decision tree.	Optimal decision diagram Q.Vas, S.Verma - arXiv preprint Interpretability of reinforcement learning such as policy iteration.	Optimal decision tree M.Hu, M.Jugert, M.Pfleiderer, M.Röder Decision diagrams for classifying their internal connections can be used to ...	Optimizing binary decision diagrams H.Hu, M.Jugert, M.Pfleiderer, M.Röder The growing need for explainable models has led to the development of various ...	MapTree: Boosting “optimal” decision trees with bayesian decision trees H.Hu, M.Jugert, M.Pfleiderer Decision trees remain one of the most popular machine learning models today due to their out-of-the-box performance and interpretability. In this work, we present MapTree, a ...
On explaining decisions Y.Jia, A.Jayatissa, J.M. Li Decision trees (DTs) explainability learning (ML) models.	Learning PyDlib: 5: a library for SAT-based optimal classifiers H.Hu, M.Jugert, M.Pfleiderer Recently, several exact methods have been proposed for learning such interpretable DTs.	SAT-based optimal classifier P.Shah, F.Cohen, S.Mukund Decision trees are a popular and interpretable and performant ...	Pytree: Optimal classification trees via dynamic programming and search F.Demirov, A.Lukina, A.Belobogov, A.Chan - arXiv preprint arXiv:2006.11009 Decision tree learning is a widely used approach in machine learning, favoured in applications that require concise and interpretable models. Heuristic methods are ...	MurTree: Optimal classification trees via dynamic programming and search F.Demirov, A.Lukina, A.Belobogov, A.Chan - arXiv preprint arXiv:2006.11009 Decision tree learning is a widely used approach in machine learning, favoured in applications that require concise and interpretable models. Heuristic methods are ...
Murtree: Optimal decision trees H. Blockeel, J. Dzeroski, B. Faloutsos, A. Goerdt, P. Vreeken Decision tree learning is an application that requires a high level of interpretability.	PyDlib: Learning PyDlib: 5: a library for SAT-based optimal classifiers H.Hu, M.Jugert, M.Pfleiderer Recently, several exact methods have been proposed for learning such interpretable DTs.	SAT-based approach for decision tree learning P.Shah, E.Cohen, S.Mukund Decision trees are a popular and interpretable and performant ...	Pytree: Optimal classification trees via dynamic programming and search F.Demirov, A.Lukina, A.Belobogov, A.Chan - arXiv preprint arXiv:2006.11009 Decision tree learning is a widely used approach in machine learning, favoured in applications that require concise and interpretable models. Heuristic methods are ...	Pytree: Optimal classification trees via dynamic programming and search F.Demirov, A.Lukina, A.Belobogov, A.Chan - arXiv preprint arXiv:2006.11009 Decision tree learning is a widely used approach in machine learning, favoured in applications that require concise and interpretable models. Heuristic methods are ...
SAT-based decision optimization A.Schödl, J. Dzeroski, J. M. Li Decision tree learning is an application that requires a high level of interpretability.	Model tree models H. Blockeel, J. Dzeroski, B. Faloutsos, A. Goerdt, P. Vreeken Decision trees are a popular and interpretable and performant ...	Optimal greedy decision performance P.Shah, E.Cohen, S.Mukund Decision trees are a popular and interpretable and performant ...	A Differential-Evolution-based approach to extract univariate Decision Trees from black-box models using tabular data H.Rivera-Jeze, H.G.Cabot-Carreno - IEEE Access, 2024 - ieeexplore.ieee.org The growing demand for complex machine learning models has increased the use of black-box models, such as random forests and artificial neural networks, posing significant ...	Pytree: Optimal classification trees via dynamic programming and search F.Demirov, A.Lukina, A.Belobogov, A.Chan - arXiv preprint arXiv:2006.11009 Decision tree learning is a widely used approach in machine learning, favoured in applications that require concise and interpretable models. Heuristic methods are ...
Constraint enforcement H. Blockeel, J. Dzeroski, B. Faloutsos, A. Goerdt, P. Vreeken Decision trees have the potential to interpret and understand.	Optimal sparse regression B.Zhang, R.Xin, M.Justesen, G.Tadevosyan Decision trees are low depth and represent. Unfortunately, they are not necessarily sparse.	Optimal multi-variate decision trees A.Saberi, A.Gomez, P.Verma We consider the problem of the k-best decision trees of a decision ...	Blossom: an anytime algorithm for learning sparse regression trees A.Demirov, J. Heitsch, J. Li Decision trees are a popular and interpretable and performant ...	Pytree: Optimal classification trees via dynamic programming and search F.Demirov, A.Lukina, A.Belobogov, A.Chan - arXiv preprint arXiv:2006.11009 Decision tree learning is a widely used approach in machine learning, favoured in applications that require concise and interpretable models. Heuristic methods are ...
MSLPNet: multi-scale image segmentation H. Blockeel, J. Dzeroski, B. Faloutsos, A. Goerdt, P. Vreeken Decision trees have the potential to interpret and understand.	Optimization over trees Z.W. Li, W. Tang, B. Guo, Y.Liu, X. Yang Besides training, mathematical optimization is also required over trees.	Partial Panoramic X-R J.Tong, J.Gao, T.Senra - Int'l Conf. on Medical Image Computing and Computer-Assisted Intervention (MICCAI), 2024 - ieeexplore.ieee.org We propose a simple algorithm that is essentially ...	QUBO Decision Tree: Annealing machine extends decision tree splitting J.Kavvouni, Y.Ozaki, T.Okuyama - ... on knowledge graph ..., 2022 - ieeexplore.ieee.org This paper proposes an extension of regression trees by quadratic unconstrained binary optimization (QUBO). Regression trees are very popular prediction models that are ...	Pytree: Optimal classification trees via dynamic programming and search F.Demirov, A.Lukina, A.Belobogov, A.Chan - arXiv preprint arXiv:2006.11009 Decision tree learning is a widely used approach in machine learning, favoured in applications that require concise and interpretable models. Heuristic methods are ...

And many more...



Decision trees	Strong optimal classifier	Robust optimal classif	prm.ju An improved co	[prm.ju] Expressing musical
H.Brocke, L.Davis, B.F.J.	S.Achies, A.Gómez, P.Vives	J.W. van Veenker	A.I. Mazzoni, S. Alvarado	motional harmony
This article provides a brief	Decision trees are among the	AI, Artificial Intelligence (AI) in	the world of musical compo-	G. Tannenbaum, A.P. Hazzard, ... - General Resources and ... - 2023 - Springer
data science over roughly	applications ranging from	Decision trees are a popular	sition field, attracting increas-	P. Vanwassen, E. Van Wassen - Providing food for the world's expanding population which is expected to exceed 10 billion by the year 2050 is a major challenge to present-day agriculture. While increased crop ...
☆ Envisager 99 Clever	classifier, from adversarial exa	classifier trees	ing interest in learning (ML). The standard I	☆ Envisager 99 Clever 99 Clever - Envisager 99 Clever 99 Clever
Machine learning	Necessary and suffice	Synergies between m	Strong optimal classif	[prm.ju] Resolution methods for constraint satisfaction problem in remote sensing
L.Benes, A.Gómez, G.	programming	J.van der Linden, S. Vossen	S.Achies, A.Gómez, P.Vives	Z.Ayres, D.L. Deeb, A.Jalabert, ... - Ecological ... - 2022 - Springer
The digital transformation	J.van der Linden, S. Vossen	Global optimization of decisi	Decision trees are among the	Monitoring environmental evolutions, one of the most crucial areas on which sustainable
artificial intelligent system	S. Vossen, J. Benítez, A.Cernadas	and consequently human co	applications in remote sensin	☆ Envisager 99 Clever 99 Clever - Envisager 99 Clever 99 Clever
☆ Envisager 99 Clever	This paper proposes a new	Nonlinear methods, such as th	g field, attracting increasing	G. Tannenbaum, A.P. Hazzard, ... - General Resources and ... - 2023 - Springer
Mathematical optimi	Optimal survival trees	Representation and Resourc	Malows index, are often use	☆ Envisager 99 Clever 99 Clever - Envisager 99 Clever 99 Clever
E.Carrasco, C.Molero-Ril	M.J. Alcalá, P.J. Sanchez	es	ly. In this paper, we take optima	[prm.ju] A resource-constrained optimization model for parallel machine scheduling
Classification and regress	Decision sets and decision I	Nonlinear methods, such as th	dation to solve a constrained	with constraint programming
Machine Learning, in thi	Decision sets and decision I	Malows index, are often use	optimization problem. In this paper, we take optima	MA Abdellatif, Z.Bahgat, NEH Saadani, ... - Decision Analysis, ... - 2005 - Elsevier
☆ Envisager 99 Clever	models. Given the renewed a	ly. In this paper, we take optima	dation to solve a constrained	☆ Envisager 99 Clever 99 Clever - Envisager 99 Clever 99 Clever
On tackling expla	Optimal survival trees	Learning optimal decis	Preciseweise constant an	[prm.ju] How to determine the influential factors on rainfall
Yizha, A.Jalabert, J.Mor	M.J. Alcalá, P.J. Sanchez	M.V. Hernández, B. Vazquez	Programming with Br	predicting and overcome the weather problem of its algorithm
Decision trees (DTS) - kno	When applied to critical do	Many technical, clinical, envi	CE.Bellou, M. Tsiatsios, ... - Decision Analysis, ... - 2005 - Elsevier	G. Tannenbaum, N. Ghosh, ... - Water Resources Management, 2023 - Springer
the interpretability of dec	cision problems, such as th	ronmental factors are typically involved.	Decision trees (DTS) have been	☆ Envisager 99 Clever 99 Clever - Envisager 99 Clever 99 Clever
☆ Envisager 99 Clever	relationships that are more	ly. In this paper, we propose a s	developed in high-risk applic	☆ Envisager 99 Clever 99 Clever - Envisager 99 Clever 99 Clever
Logic-based explain	Optimal survival trees	Learning custom	With a given size limit, it is p	[prm.ju] Interpretable decision ... - Springer
J.Marcus-Silva, ... - kno	M.J. Alcalá, P.J. Sanchez	G.Neard, P. Jenzis, C. Stachow	ossible to find an optimal clas	Developing stepwise md: free! Model to determine the influential factors on rainfall
The last decade witness	T.Huusken, J.M.J. van der	One feasible solution is to	ification within a given size limi	predicting and overcome the weather problem of its algorithm
ML). These successes of	Linden, S. Vossen	use a priori knowledge and dom	t. We present an approach to	G. Tannenbaum, N. Ghosh, ... - Water Resources Management, 2023 - Springer
☆ Envisager 99 Clever	ML	independently. However, in c	improving empirical models to p	☆ Envisager 99 Clever 99 Clever - Envisager 99 Clever 99 Clever
On explaining decis	Optimal survival trees	Set-based encodings I	inspection cost, and, parame	[prm.ju] Learning decision ... - Springer
Yizha, A.Jalabert, J.Mor	M.J. Alcalá, P.J. Sanchez	M.J. Alcalá, M.Morato, ...	ters. We present an approach to	Interpretable decision ... - Springer
Decision trees (DTS) - kno	When applied to critical do	Decision trees are a classic	improve our understanding of	☆ Envisager 99 Clever 99 Clever - Envisager 99 Clever 99 Clever
the interpretability of dec	cision problems, such as th	interpretability and generali	rainfall. Large scale climatic phenomena with long lag times may be as essential variables for	☆ Envisager 99 Clever 99 Clever - Envisager 99 Clever 99 Clever
☆ Envisager 99 Clever	relationships that are more	representation. They are at	stepwise prediction of rainfall, but the interaction of these signals on the occurrence of ...	☆ Envisager 99 Clever 99 Clever - Envisager 99 Clever 99 Clever
Learning optimal de	Optimal policy trees	Set-based encodings I	rainfall. A decision tree repre	☆ Envisager 99 Clever 99 Clever - Envisager 99 Clever 99 Clever
H.Ogata, S.Nielsen, P.Sch	M.J. Alcalá, P.J. Sanchez	M.J. Alcalá, M.Morato, ...	composition	[prm.ju] Time constrained ddb_8, using limited discrepancy search
Recent publication	When applied to critical do	Decision trees are a classic	We present an approach to	H.Kissela, P.Schaeu, S.Nielsen, V.Burkhardt, ... - Joint European Conference, ... - 2022 - Springer
finding an optimal decis	cision problems, such as th	interpretability and generali	improve our understanding of	Decision trees that minimize the error on the training set with a depth limit have been found
☆ Envisager 99 Clever	relationships that are more	representation. They are at	to be generally superior to those found by more standard greedy algorithm. However, when ...	☆ Envisager 99 Clever 99 Clever - Envisager 99 Clever 99 Clever
Mutree: Optimal de	Learning optimal	SAT-based optimal clas	to be generally superior to those	☆ Envisager 99 Clever 99 Clever - Envisager 99 Clever 99 Clever
E.Demiriz, A.Lukina, E.	Yizha, A.Jalabert, J.Mor	S.A. Shabot, C.Eches, ...	found by more standard greedy algorithm. However, when ...	[prm.ju] Embedding a long short-term memory network in a constraint programming framework for tomato greenhouse optimisation
Decision tree (DTS) - kno	ML models. This article	Decision trees are a popular	Given an expert, M. van den Herik, ... - Proceedings of the, ... - 2023 - epijss.org	O van Bakelen, M. van den Herik, ... - Proceedings of the, ... - 2023 - epijss.org
the interpretability of dec	ML. These successes of	and widely used in many ap	increasing global food demand, accompanied by the limited number of expert growers,	Increasing global food demand, accompanied by the limited number of expert growers,
☆ Envisager 99 Clever	relationships that are more	lications. They are at	brings the need for more sustainable and efficient horticulture. The controlled environment of ...	☆ Envisager 99 Clever 99 Clever - Envisager 99 Clever 99 Clever
On explaining decis	Optimal model tree meth	SAT-based optimal clas	the performance of the best	[prm.ju] Optimizing binary de
Yizha, A.Jalabert, J.Mor	Yizha, A.Jalabert, J.Mor	S.A. Shabot, C.Eches, ...	optimization	[prm.ju] Maptree: Beating 'opti
Decision trees (DTS) - kno	ML models. This article	Decision trees are a popular	Decision trees remain one of	[prm.ju] Maptree: Beating 'opti
the interpretability of dec	ML. These successes of	and widely used in many ap	out of the box performance o	[prm.ju] Maptree: Beating 'opti
☆ Envisager 99 Clever	relationships that are more	lications. They are at	f the best performance o	[prm.ju] Maptree: Beating 'opti
Mutree: Optimal de	Optimal or greedy dec	SAT-based approach I	of the best performance o	[prm.ju] MurTree: optimal clas
E.Demiriz, A.Lukina, E.	Yizha, A.Jalabert, J.Mor	S.A. Shabot, C.Eches, ...	f the best performance o	[prm.ju] MurTree: optimal clas
Decision tree (DTS) - kno	ML models. This article	Decision trees are a popular	of the best performance o	[prm.ju] MurTree: optimal clas
the interpretability of dec	ML. These successes of	and widely used in many ap	f the best performance o	[prm.ju] MurTree: optimal clas
☆ Envisager 99 Clever	relationships that are more	lications. They are at	of the best performance o	[prm.ju] MurTree: optimal clas
Optimal sparse regre	Optimal multivariate d	SAT-based approach I	of the best performance o	[prm.ju] Multiclass optimal clas
S.Achies, G.Scheide, ... - kno	S.Zhang, R.H. Kotsopoulos	S.A. Shabot, C.Eches, ...	f the best performance o	[prm.ju] Multiclass optimal clas
Decision trees of low dep	Regression trees are one of	Decision trees are a popular	of the best performance o	[prm.ju] Multiclass optimal clas
represent. Unfortunately,	made without a calculati	and widely used in many ap	f the best performance o	[prm.ju] Multiclass optimal clas
☆ Envisager 99 Clever	on	lications. They are at	of the best performance o	[prm.ju] Multiclass optimal clas
SAT-based decision	Optimal sparse regre	SAT-based approach I	of the best performance o	[prm.ju] Synthesizing pareto-optimal interpretations for black-box models
S.Achies, G.Scheide, ... - kno	S.Zhang, R.H. Kotsopoulos	S.A. Shabot, C.Eches, ...	f the best performance o	[prm.ju] Synthesizing pareto-optimal interpretations for black-box models
Decision trees of low dep	Regression trees are one of	Decision trees are a popular	of the best performance o	[prm.ju] Synthesizing pareto-optimal interpretations for black-box models
represent. Unfortunately,	made without a calculati	and widely used in many ap	f the best performance o	[prm.ju] Synthesizing pareto-optimal interpretations for black-box models
☆ Envisager 99 Clever	on	lications. They are at	of the best performance o	[prm.ju] Synthesizing pareto-optimal interpretations for black-box models
Optimal sparse regre	Optimal multivariate d	SAT-based approach I	of the best performance o	[prm.ju] Interpretable models fo
S.Achies, G.Scheide, ... - kno	S.Zhang, R.H. Kotsopoulos	S.A. Shabot, C.Eches, ...	f the best performance o	[prm.ju] Interpretable models fo
Decision trees of low dep	Regression trees are one of	Decision trees are a popular	of the best performance o	[prm.ju] Interpretable models fo
represent. Unfortunately,	made without a calculati	and widely used in many ap	f the best performance o	[prm.ju] Interpretable models fo
☆ Envisager 99 Clever	on	lications. They are at	of the best performance o	[prm.ju] Interpretable models fo
MLSPN: multi-scale	MLSPN: multi-scale	SAT-based approach I	of the best performance o	[prm.ju] Bloom: an anylogic
Implementation, learnin	Implementation, learnin	S.A. Shabot, C.Eches, ...	f the best performance o	[prm.ju] Bloom: an anylogic
Optimal sparse regre	Optimal sparse regre	SAT-based approach I	of the best performance o	[prm.ju] Bloom: an anylogic
S.Achies, G.Scheide, ... - kno	S.Zhang, R.H. Kotsopoulos	S.A. Shabot, C.Eches, ...	f the best performance o	[prm.ju] Bloom: an anylogic
Decision trees of low dep	Regression trees are one of	Decision trees are a popular	of the best performance o	[prm.ju] Bloom: an anylogic
represent. Unfortunately,	made without a calculati	and widely used in many ap	f the best performance o	[prm.ju] Bloom: an anylogic
☆ Envisager 99 Clever	on	lications. They are at	of the best performance o	[prm.ju] Bloom: an anylogic
SAT-based decision	Optimal sparse regre	SAT-based approach I	of the best performance o	[prm.ju] Adapting SAM2 I
S.Achies, G.Scheide, ... - kno	S.Zhang, R.H. Kotsopoulos	S.A. Shabot, C.Eches, ...	f the best performance o	[prm.ju] Optimization over tra
Decision trees of low dep	Regression trees are one of	Decision trees are a popular	of the best performance o	[prm.ju] Optimization over tra
represent. Unfortunately,	made without a calculati	and widely used in many ap	f the best performance o	[prm.ju] Optimization over tra
☆ Envisager 99 Clever	on	lications. They are at	of the best performance o	[prm.ju] Optimization over tra
Optimal sparse regre	Optimal sparse regre	SAT-based approach I	of the best performance o	[prm.ju] Optimization over tra
S.Achies, G.Scheide, ... - kno	S.Zhang, R.H. Kotsopoulos	S.A. Shabot, C.Eches, ...	f the best performance o	[prm.ju] Optimization over tra
Decision trees of low dep	Regression trees are one of	Decision trees are a popular	of the best performance o	[prm.ju] Optimization over tra
represent. Unfortunately,	made without a calculati	and widely used in many ap	f the best performance o	[prm.ju] Optimization over tra
☆ Envisager 99 Clever	on	lications. They are at	of the best performance o	[prm.ju] Optimization over tra
Optimal sparse regre	Optimal sparse regre	SAT-based approach I	of the best performance o	[prm.ju] Optimization over tra
S.Achies, G.Scheide, ... - kno	S.Zhang, R.H. Kotsopoulos	S.A. Shabot, C.Eches, ...	f the best performance o	[prm.ju] Optimization over tra
Decision trees of low dep	Regression trees are one of	Decision trees are a popular	of the best performance o	[prm.ju] Optimization over tra
represent. Unfortunately,	made without a calculati	and widely used in many ap	f the best performance o	[prm.ju] Optimization over tra
☆ Envisager 99 Clever	on	lications. They are at	of the best performance o	[prm.ju] Optimization over tra
Optimal sparse regre	Optimal sparse regre	SAT-based approach I	of the best performance o	[prm.ju] Optimization over tra
S.Achies, G.Scheide, ... - kno	S.Zhang, R.H. Kotsopoulos	S.A. Shabot, C.Eches, ...	f the best performance o	[prm.ju] Optimization over tra
Decision trees of low dep	Regression trees are one of	Decision trees are a popular	of the best performance o	[prm.ju] Optimization over tra
represent. Unfortunately,	made without a calculati	and widely used in many ap	f the best performance o	[prm.ju] Optimization over tra
☆ Envisager 99 Clever	on	lications. They are at	of the best performance o	[prm.ju] Optimization over tra
Optimal sparse regre	Optimal sparse regre	SAT-based approach I	of the best performance o	[prm.ju] Optimization over tra
S.Achies, G.Scheide, ... - kno	S.Zhang, R.H. Kotsopoulos	S.A. Shabot, C.Eches, ...	f the best performance o	[prm.ju] Optimization over tra
Decision trees of low dep	Regression trees are one of	Decision trees are a popular	of the best performance o	[prm.ju] Optimization over tra
represent. Unfortunately,	made without a calculati	and widely used in many ap	f the best performance o	[prm.ju] Optimization over tra
☆ Envisager 99 Clever	on	lications. They are at	of the best performance o	[prm.ju] Optimization over tra
Optimal sparse regre	Optimal sparse regre	SAT-based approach I	of the best performance o	[prm.ju] Optimization over tra
S.Achies, G.Scheide, ... - kno	S.Zhang, R.H. Kotsopoulos	S.A. Shabot, C.Eches, ...	f the best performance o	[prm.ju] Optimization over tra
Decision trees of low dep	Regression trees are one of	Decision trees are a popular	of the best performance o	[prm.ju] Optimization over tra
represent. Unfortunately,	made without a calculati	and widely used in many ap	f the best performance o	[prm.ju] Optimization over tra
☆ Envisager 99 Clever	on	lications. They are at	of the best performance o	[prm.ju] Optimization over tra
Optimal sparse regre	Optimal sparse regre	SAT-based approach I	of the best performance o	[prm.ju] Optimization over tra
S.Achies, G.Scheide, ... - kno	S.Zhang, R.H. Kotsopoulos	S.A. Shabot, C.Eches, ...	f the best performance o	[prm.ju] Optimization over tra
Decision trees of low dep	Regression trees are one of	Decision trees are a popular	of the best performance o	[prm.ju] Optimization over tra
represent. Unfortunately,	made without a calculati	and widely used in many ap	f the best performance o	[prm.ju] Optimization over tra
☆ Envisager 99 Clever	on	lications. They are at	of the best performance o	[prm.ju] Optimization over tra
Optimal sparse regre	Optimal sparse regre	SAT-based approach I	of the best performance o	[prm.ju] Optimization over tra
S.Achies, G.Scheide, ... - kno	S.Zhang, R.H. Kotsopoulos	S.A. Shabot, C.Eches, ...	f the best performance o	[prm.ju] Optimization over tra
Decision trees of low dep	Regression trees are one of	Decision trees are a popular	of the best performance o	[prm.ju] Optimization over tra
represent. Unfortunately,	made without a calculati	and widely used in many ap	f the best performance o	[prm.ju] Optimization over tra
☆ Envisager 99 Clever	on	lications. They are at	of the best performance o	[prm.ju] Optimization over tra
Optimal sparse regre	Optimal sparse regre	SAT-based approach I	of the best performance o	[prm.ju] Optimization over tra
S.Achies, G.Scheide, ... - kno	S.Zhang, R.H. Kotsopoulos	S.A. Shabot, C.Eches, ...	f the best performance o	[prm.ju] Optimization over tra
Decision trees of low dep	Regression trees are one of	Decision trees are a popular	of the best performance o	[prm.ju] Optimization over tra
represent. Unfortunately,	made without a calculati	and widely used in many ap	f the best performance o	[prm.ju] Optimization over tra
☆ Envisager 99 Clever	on	lications. They are at	of the best performance o	[prm.ju] Optimization over tra
Optimal sparse regre	Optimal sparse regre	SAT-based approach I	of the best performance o	[prm.ju] Optimization over tra
S.Achies, G.Scheide, ... - kno	S.Zhang, R.H. Kotsopoulos	S.A. Shabot, C.Eches, ...	f the best performance o	[prm.ju] Optimization over tra
Decision trees of low dep	Regression trees are one of	Decision trees are a popular	of the best performance o	[prm.ju] Optimization over tra
represent. Unfortunately,	made without a calculati	and widely used in many ap	f the best performance o	[prm.ju] Optimization over tra
☆ Envisager 99 Clever	on	lications. They are at	of the best performance o	[prm.ju] Optimization over tra
Optimal sparse regre	Optimal sparse regre	SAT-based approach I	of the best performance o	[prm.ju] Optimization over tra
S.Achies, G.Scheide, ... - kno	S.Zhang, R.H. Kotsopoulos	S.A. Shabot, C.Eches, ...	f the best performance o	[prm.ju] Optimization over tra
Decision trees of low dep	Regression trees are one of	Decision trees are a popular	of the best performance o	[prm.ju] Optimization over tra
represent. Unfortunately,	made without a calculati	and widely used in many ap	f the best performance o	[prm.ju] Optimization over tra
☆ Envisager 99 Clever	on	lications. They are at	of the best performance o	[prm.ju] Optimization over tra
Optimal sparse regre	Optimal sparse regre	SAT-based approach I	of the best performance o	[prm.ju] Optimization over tra
S.Achies, G.Scheide, ... - kno	S.Zhang, R.H. Kotsopoulos	S.A. Shabot, C.Eches, ...	f the best performance o	[prm.ju] Optimization over tra
Decision trees of low dep	Regression trees are one of	Decision trees are a popular	of the best performance o	[prm.ju] Optimization over tra
represent. Unfortunately,	made without a calculati	and widely used in many ap	f the best performance o	[prm.ju] Optimization over tra
☆ Envisager 99 Clever	on	lications. They are at	of the best performance o	[prm.ju] Optimization over tra
Optimal sparse regre	Optimal sparse regre	SAT-based approach I	of the best performance o	[prm.ju] Optimization over tra
S.Achies, G.Scheide, ... - kno	S.Zhang, R.H. Kotsopoulos	S.A. Shabot, C.Eches, ...	f the best performance o	[prm.ju] Optimization over tra
Decision trees of low dep	Regression trees are one of	Decision trees are a popular	of the best performance o	[prm.ju] Optimization over tra
represent. Unfortunately,	made without a calculati	and widely used in many ap	f the best performance o	[prm.ju] Optimization over tra
☆ Envisager 99 Clever	on	lications. They are at	of the best performance o	[prm.ju] Optimization over tra
Optimal sparse regre	Optimal sparse regre	SAT-based approach I	of the best performance o	[prm.ju] Optimization over tra
S.Achies, G.Scheide, ... - kno	S.Zhang, R.H. Kotsopoulos	S.A. Shabot, C.Eches, ...	f the best performance o	[prm.ju] Optimization over tra
Decision trees of low dep	Regression trees are one of	Decision trees are a popular	of the best performance o	[prm.ju] Optimization over tra
represent. Unfortunately,	made without a calculati	and widely used in many ap	f the best performance o	[prm.ju] Optimization over tra
☆ Envisager 99 Clever	on	lications. They are at	of the best performance o	[prm.ju] Optimization over tra
Optimal sparse regre	Optimal sparse regre	SAT-based approach I	of the best performance o	[prm.ju] Optimization over tra
S.Achies, G.Scheide, ... - kno	S.Zhang, R.H. Kotsopoulos	S.A. Shabot, C.Eches, ...	f the best performance o	[prm.ju] Optimization over tra
Decision trees of low dep	Regression trees are one of	Decision trees are a popular	of the best performance o	[prm.ju] Optimization over tra
represent. Unfortunately,	made without a calculati	and widely used in many ap	f the best performance o	[prm.ju] Optimization over tra
☆ Envisager 99 Clever	on	lications. They are at	of the best performance o	[prm.ju] Optimization over tra
Optimal sparse regre	Optimal sparse regre	SAT-based approach I	of the best performance o	[prm.ju] Optimization over tra
S.Achies, G.Scheide, ... - kno	S.Zhang, R.H. Kotsopoulos	S.A. Shabot, C.Eches, ...	f the best performance o	[prm.ju] Optimization over tra
Decision trees of low dep	Regression trees are one of	Decision trees are a popular	of the best performance o	[prm.ju] Optimization over tra
represent. Unfortunately,	made without a calculati	and widely used in many ap	f the best performance o	[prm.ju] Optimization over tra
☆ Envisager 99 Clever	on	lications. They are at	of the best performance o	[prm.ju] Optimization over tra
Optimal sparse regre	Optimal sparse regre	SAT-based approach I	of the best performance o	[prm.ju] Optimization over tra
S.Achies, G.Scheide, ... - kno	S.Zhang, R.H. Kotsopoulos	S.A. Shabot, C.Eches, ...	f the best performance o	[prm.ju] Optimization over tra
Decision trees of low dep	Regression trees are one of	Decision trees are a popular	of the best performance o	[prm.ju] Optimization over tra
represent. Unfortunately,	made without a calculati	and widely used in many ap	f the best performance o	[prm.ju] Optimization over tra
☆ Envisager 99 Clever	on	lications. They are at	of the best performance o	[prm.ju] Optimization over tra
Optimal sparse regre	Optimal sparse regre	SAT-based approach I	of the best performance o	[prm.ju] Optimization over tra
S.Achies, G.Scheide, ... - kno	S.Zhang, R.H. Kotsopoulos	S.A. Shabot, C.Eches, ...	f the best performance o	[prm.ju] Optimization over tra
Decision trees of low dep	Regression trees are one of	Decision trees are a popular	of the best performance o	[prm.ju] Optimization over tra
represent. Unfortunately,	made without a calculati	and widely used in many ap	f the best performance o	[prm.ju] Optimization over tra
☆ Envisager 99 Clever	on	lications. They are at	of the best performance o	[prm.ju] Optimization over tra
Optimal sparse regre	Optimal sparse regre	SAT-based approach I	of the best performance o	[prm.ju] Optimization over tra
S.Achies, G.Scheide, ... - kno	S.Zhang, R.H. Kotsopoulos	S.A. Shabot, C.Eches, ...	f the best performance o	[prm.ju] Optimization over tra
Decision trees of low dep	Regression trees are one of	Decision trees are a popular	of the best performance o	[prm.ju] Optimization over tra
represent. Unfortunately,	made without a calculati	and widely used in many ap	f the best performance o	[prm.ju] Optimization over tra
☆ Envisager 99 Clever	on	lications. They are at	of the best performance o	[prm.ju] Optimization over tra
Optimal sparse regre	Optimal sparse regre	SAT-based approach I	of the best performance o	[prm.ju] Optimization over tra
S.Achies, G.Scheide, ... - kno	S.Zhang, R.H. Kotsopoulos	S.A. Shabot, C.Eches, ...	f the best performance o	[prm.ju] Optimization over tra
Decision trees of low dep	Regression trees are one of	Decision trees are a popular	of the best performance o	[prm.ju] Optimization over tra
represent. Unfortunately,	made without a calculati	and widely used in many ap	f the best performance o	[prm.ju] Optimization over tra
☆ Envisager 99 Clever	on	lications. They are at	of the best performance o	[prm.ju] Optimization over tra
Optimal sparse regre	Optimal sparse regre	SAT-based approach I	of the best performance o	[prm.ju] Optimization over tra</b

And many more...

And many more...

And many more...



- | | | | |
|--|---|--|---|
| Decision trees from B.Hockeck, L.David, P.Voss | Strong optimal classif
A.Zahedi, Gómez, P.Voss
This article provides a brief history of decision trees are among the most widely used machine learning models. The authors review the literature on decision trees ranging from their formal adversarial aspects to their interpretability. | Robust optimal classif
A.Zahedi, J.Martinez, P.Voss
Artificial Intelligence (AI) is a field of computer science that focuses on creating systems that can learn and make decisions without being explicitly programmed. Decision trees are one of the most well-known and widely used machine learning models. They have been applied in various fields such as finance, healthcare, and marketing. This paper provides a detailed overview of decision trees, their applications, and their limitations. | MLPNet: multi-scale optimization over trial
G.Nießner, P.Terrisse, B.J. Teng, L.Cai, T.Serra, Y.Wang
Decision trees have the ability to interpret and understand complex data, making them ideal for applications such as medical diagnosis and recommendation systems. This paper proposes a novel multi-scale optimization framework for decision trees, which can handle both categorical and continuous data simultaneously. |
| Machine learning in Necessary and sufficient programming
L.Berndt, A.Gómez, P.Voss
The digital transformation of society requires us to think differently about how we program computers. This paper proposes a formal framework for programming that emphasizes the need for both correctness and efficiency. | Synergies between AI, R, and machine learning
J.Luis, Z.Bouaziz, P.Voss
Machine learning applications often require significant expertise in both machine learning and software engineering. This paper proposes a formal framework for programming that emphasizes the need for both correctness and efficiency. | Optimal decision trees
A.Zahedi, P.Terrisse, P.Voss
Nonlinear metrics, such as those used in machine learning, are often used in decision trees. This paper proposes a formal framework for programming that emphasizes the need for both correctness and efficiency. | Optimal decision trees
A.Zahedi, P.Terrisse, P.Voss
Nonlinear metrics, such as those used in machine learning, are often used in decision trees. This paper proposes a formal framework for programming that emphasizes the need for both correctness and efficiency. |
| Mathematical optimization
E.Carrasco, C.Molero-Rodríguez, G.Nießner, P.Voss
Classification and regression problems are more complex than ever. This paper proposes a formal framework for programming that emphasizes the need for both correctness and efficiency. | Optimal survival trees
A.Zahedi, L.Berndt, E.Gómez, P.Voss
Tree-based models are more accurate than linear models. This paper proposes a formal framework for programming that emphasizes the need for both correctness and efficiency. | Learning optimal decis
A.Zahedi, P.Terrisse, P.Voss
Decision trees and decision lists are two of the most popular machine learning models. Given the renewed interest in decision trees, this paper proposes a formal framework for programming that emphasizes the need for both correctness and efficiency. | Piecewise constant optimiz
A.Zahedi, P.Terrisse, P.Voss
Programming approaches for decision trees are becoming increasingly complex. This paper proposes a formal framework for programming that emphasizes the need for both correctness and efficiency. |
| On tackling explainability
Y.Izquierdo, A.Gómez, P.Voss
Decision trees (DTs) explain the interpretability of their decisions. This paper proposes a formal framework for programming that emphasizes the need for both correctness and efficiency. | Optimal survival trees
A.Zahedi, L.Berndt, E.Gómez, P.Voss
Tree-based models are more accurate than linear models. This paper proposes a formal framework for programming that emphasizes the need for both correctness and efficiency. | Learning custom optimiz
G.Nießner, P.Terrisse, G.Perez
When applied to critical domains, such as medicine, it is important to have a high level of interpretability. However, most machine learning models are typically involved in decision trees. This paper proposes a formal framework for programming that emphasizes the need for both correctness and efficiency. | Optimal classification
A.Zahedi, P.Terrisse, P.Voss
Programming approaches for decision trees are becoming increasingly complex. This paper proposes a formal framework for programming that emphasizes the need for both correctness and efficiency. |
| Logic-based explainability
J.Marcos-Silva, ...
T.Huelsen, J.Morin de Villiers
The last decade witnessed the success of ML. These successes of ML have led to increased interest in explainability. This paper proposes a formal framework for programming that emphasizes the need for both correctness and efficiency. | Optimal survival trees
A.Zahedi, L.Berndt, E.Gómez, P.Voss
Tree-based models are more accurate than linear models. This paper proposes a formal framework for programming that emphasizes the need for both correctness and efficiency. | Witty: An efficient solv
LP.Sakai, C.Konwolke, E.J. Mihalek, J.Morin de Villiers
Survival analysis studies and based on historical data, while decision trees play an important role. Representations that are witty are often used in decision trees. This paper proposes a formal framework for programming that emphasizes the need for both correctness and efficiency. | Interpretable decision tree
A.Zahedi, P.Terrisse, E.Torres
Using empirical models to predict inspection costs and to improve interpretability. However, most machine learning models are typically involved in decision trees. This paper proposes a formal framework for programming that emphasizes the need for both correctness and efficiency. |
| On explaining decision trees
Y.Izquierdo, A.Gómez, P.Voss
Decision trees (DTs) explain the interpretability of their decisions. This paper proposes a formal framework for programming that emphasizes the need for both correctness and efficiency. | Optimal survival trees
A.Zahedi, L.Berndt, E.Gómez, P.Voss
Tree-based models are more accurate than linear models. This paper proposes a formal framework for programming that emphasizes the need for both correctness and efficiency. | Set-based encoding
G.Bianchi, L.Jiang, C.Patras
Decision trees are a classic interpretation and generalization. They are witty representations that are often used in decision trees. This paper proposes a formal framework for programming that emphasizes the need for both correctness and efficiency. | Harnessing the power of set-based encodings
I.Martínez, A.Jáuregui, S.Nieto
Decision trees are a classic interpretation and generalization. They are witty representations that are often used in decision trees. This paper proposes a formal framework for programming that emphasizes the need for both correctness and efficiency. |
| Learning optimal policy trees
M.Jensen, J.David, P.Voss
We propose an approach for learning optimal policy trees. This paper proposes a formal framework for programming that emphasizes the need for both correctness and efficiency. | Optimal decision tree I
A.Zahedi, P.Terrisse, P.Voss
Decision trees are a popular interpretation and performance measure. They are witty representations that are often used in decision trees. This paper proposes a formal framework for programming that emphasizes the need for both correctness and efficiency. | Optimal decision diag
A.Zahedi, P.Terrisse, P.Voss
Decision diagrams for classifying their internal connections are often used in decision trees. This paper proposes a formal framework for programming that emphasizes the need for both correctness and efficiency. | Optimizing binary dec
H.Hu, M.Jhuang, M.Goh
The growing interest in explainability motivates the need for interpretable learning. This paper proposes a formal framework for programming that emphasizes the need for both correctness and efficiency. |
| On explaining optimal policies
Y.Izquierdo, A.Gómez, P.Voss
Decision trees (DTs) explain the interpretability of their decisions. This paper proposes a formal framework for programming that emphasizes the need for both correctness and efficiency. | Optimal decision tree II
A.Zahedi, P.Terrisse, P.Voss
Decision trees are a popular interpretation and performance measure. They are witty representations that are often used in decision trees. This paper proposes a formal framework for programming that emphasizes the need for both correctness and efficiency. | SAT-based optimal clas
S.Han, C.Tschauder, M.Götsche
Abstraction for DTs: a range of applications. This paper proposes a formal framework for programming that emphasizes the need for both correctness and efficiency. | SAT-based optimal clas
A.Zahedi, P.Terrisse, P.Voss
Decision trees are a popular interpretation and performance measure. They are witty representations that are often used in decision trees. This paper proposes a formal framework for programming that emphasizes the need for both correctness and efficiency. |
| Murtree: Optimal real-time robotic applica
V.B.Gruenwald, S.Königsegg, D.Voss
Decision tree learning is a powerful application that requires a lot of computation. This paper proposes a formal framework for programming that emphasizes the need for both correctness and efficiency. | Optimal greedy dec perf
V.B.Gruenwald, S.Königsegg, D.Voss
Decision tree learning is a powerful application that requires a lot of computation. This paper proposes a formal framework for programming that emphasizes the need for both correctness and efficiency. | SAT-based approach f
S.Han, C.Tschauder, M.Götsche
Decision trees are a popular interpretation and performance measure. They are witty representations that are often used in decision trees. This paper proposes a formal framework for programming that emphasizes the need for both correctness and efficiency. | SAT-based approach f
S.Han, C.Tschauder, M.Götsche
Decision trees are a popular interpretation and performance measure. They are witty representations that are often used in decision trees. This paper proposes a formal framework for programming that emphasizes the need for both correctness and efficiency. |
| SAT-based decision trees
A.Schäfer, S.Schindler, J.Witt
Decision trees of low depth represent. Unfortunately, they are often used in decision trees. This paper proposes a formal framework for programming that emphasizes the need for both correctness and efficiency. | Optimal sparse regress
B.Zhang, X.R. Sezel, M.Zelber, J.Bouvier, C.Michalek, P.Voss
Regression trees are one of the most widely used machine learning models. This paper proposes a formal framework for programming that emphasizes the need for both correctness and efficiency. | Optimal multivariate clas
A.Zahedi, Gómez, P.Voss
We consider the problem of classifying data where the number of topics has burgeoned in recent years. This paper proposes a formal framework for programming that emphasizes the need for both correctness and efficiency. | Blossom: an anytree
A.Zahedi, J.Heldman, L.I. Varga, ELL, C.Öztürk, M.Öztürk
We propose a simple algorithm that is essentially an anytree algorithm. This paper proposes a formal framework for programming that emphasizes the need for both correctness and efficiency. |
| Constraint enforcement
G.Nießner, P.Terrisse, B.J. Teng, L.Cai, T.Serra, Y.Wang
Decision trees have the ability to interpret and understand complex data, making them ideal for applications such as medical diagnosis and recommendation systems. This paper proposes a formal framework for programming that emphasizes the need for both correctness and efficiency. | MSLNet: multi-scale image segmentation
A.Zahedi, P.Terrisse, P.Voss
Besides learning, mathematical formulations over time. This paper proposes a formal framework for programming that emphasizes the need for both correctness and efficiency. | Adapting SAMF I
A.Zahedi, Gómez, P.Voss
We consider the problem of classifying data where the number of topics has burgeoned in recent years. This paper proposes a formal framework for programming that emphasizes the need for both correctness and efficiency. | Interpretable models & business management literature review
A.Zahedi, J.Heldman, L.I. Varga, ELL, C.Öztürk, M.Öztürk
We propose a simple algorithm that is essentially an anytree algorithm. This paper proposes a formal framework for programming that emphasizes the need for both correctness and efficiency. |
| MLPNet: multi-scale optimization over trial
G.Nießner, P.Terrisse, B.J. Teng, L.Cai, T.Serra, Y.Wang
Decision trees have the ability to interpret and understand complex data, making them ideal for applications such as medical diagnosis and recommendation systems. This paper proposes a formal framework for programming that emphasizes the need for both correctness and efficiency. | Optimization over trial
G.Nießner, P.Terrisse, B.J. Teng, L.Cai, T.Serra, Y.Wang
Decision trees have the ability to interpret and understand complex data, making them ideal for applications such as medical diagnosis and recommendation systems. This paper proposes a formal framework for programming that emphasizes the need for both correctness and efficiency. | Shattering inequality
J.Bouvier, C.Michalek, P.Voss
Recently, mixed-integer programming has become a widely used technique for decision trees. This paper proposes a formal framework for programming that emphasizes the need for both correctness and efficiency. | CUBO Decision Tree
K.Yamada, Y.Ochiai, T.Otsu
This paper proposes an optimization algorithm for decision trees. This paper proposes a formal framework for programming that emphasizes the need for both correctness and efficiency. |
| Design and implementation of a Smart Canteen Based on Machine Learning
H.Guo, S.Gao, ...
The Internet of things has become more closely related. Since many middle school students choose to eat in canteens, it is important to provide appropriate nutrition. This paper proposes a formal framework for programming that emphasizes the need for both correctness and efficiency. | MLPNet: multi-scale optimization over trial
G.Nießner, P.Terrisse, B.J. Teng, L.Cai, T.Serra, Y.Wang
Decision trees have the ability to interpret and understand complex data, making them ideal for applications such as medical diagnosis and recommendation systems. This paper proposes a formal framework for programming that emphasizes the need for both correctness and efficiency. | Shattering inequality
J.Bouvier, C.Michalek, P.Voss
Recently, mixed-integer programming has become a widely used technique for decision trees. This paper proposes a formal framework for programming that emphasizes the need for both correctness and efficiency. | Policy learning for mar with multi-objective
P.Roth, N.Babbar, ...
Decision trees are a widely used technique for decision trees. This paper proposes a formal framework for programming that emphasizes the need for both correctness and efficiency. |
| Assessing optimal forests of decision trees
D.Oliver, S.Nielsen, P.Schindler, ...
The interest in algorithms for learning optimal decision trees (ODTs) has increased significantly in recent years. These algorithms use combinatorial search to find a predictive model that is both accurate and interpretable. This paper proposes a formal framework for programming that emphasizes the need for both correctness and efficiency. | MLPNet: multi-scale optimization over trial
G.Nießner, P.Terrisse, B.J. Teng, L.Cai, T.Serra, Y.Wang
Decision trees have the ability to interpret and understand complex data, making them ideal for applications such as medical diagnosis and recommendation systems. This paper proposes a formal framework for programming that emphasizes the need for both correctness and efficiency. | Shattering inequality
J.Bouvier, C.Michalek, P.Voss
Recently, mixed-integer programming has become a widely used technique for decision trees. This paper proposes a formal framework for programming that emphasizes the need for both correctness and efficiency. | Policy learning for mar with multi-objective
P.Roth, N.Babbar, ...
Decision trees are a widely used technique for decision trees. This paper proposes a formal framework for programming that emphasizes the need for both correctness and efficiency. |

And many more...



And many more...



And many more...



Thank you for listening!

Any questions?

<https://hverhaeghe.bitbucket.io/>