

CS 171: Intro to ML and DM

Christian Shelton

UC Riverside

Slide Set 13: Decision Trees III



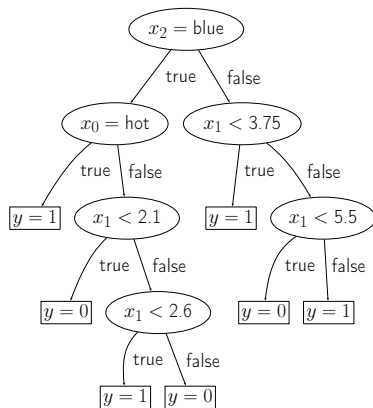
- From UC Riverside

- ▶ CS 171: Introduction to Machine Learning and Data Mining
- ▶ Professor Christian Shelton

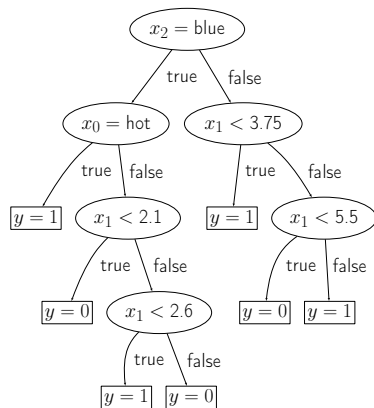
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 - ▶ Elements of Statistical Learning (Hastie, et al.)
 - ▶ Pattern Recognition and Machine Learning (Bishop)
 - ▶ An Introduction to Machine Learning (Kubat)
 - ▶ Machine Learning: A Probabilistic Perspective (Murphy)
- ▶ For use only by enrolled students in the course

Decision Tree as a Rule Set



Decision Tree as a Rule Set



$$(x_2 = \text{blue} \wedge x_0 = \text{hot}) \rightarrow y = 1$$

$$(x_2 = \text{blue} \wedge x_0 \neq \text{hot} \wedge x_1 < 2.1) \rightarrow y = 0$$

$$(x_2 = \text{blue} \wedge x_0 \neq \text{hot} \wedge x_1 \geq 2.1 \wedge x_1 < 2.6) \rightarrow y = 1$$

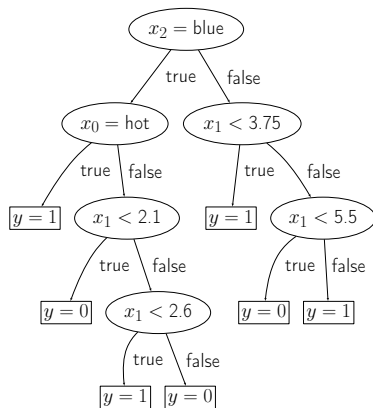
$$(x_2 = \text{blue} \wedge x_0 \neq \text{hot} \wedge x_1 \geq 2.1 \wedge x_1 \geq 2.6) \rightarrow y = 0$$

$$(x_2 \neq \text{blue} \wedge x_1 < 3.75) \rightarrow y = 1$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 3.75 \wedge x_1 < 5.5) \rightarrow y = 0$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 3.75 \wedge x_1 \geq 5.5) \rightarrow y = 1$$

Decision Tree as a Rule Set



$$(x_2 = \text{blue} \wedge x_0 = \text{hot}) \rightarrow y = 1$$

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$$(x_2 \neq \text{blue} \wedge x_1 < 3.75) \rightarrow y = 1$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 3.75 \wedge x_1 < 5.5) \rightarrow y = 0$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 5.5) \rightarrow y = 1$$

Pruning Decision Rules

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_2 = \text{blue} \wedge x_0 = \text{hot}) \rightarrow y = 1$$

$$(x_2 = \text{blue} \wedge x_0 \neq \text{hot} \wedge x_1 < 2.1) \rightarrow y = 0$$

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hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_2 = \text{blue} \wedge x_0 = \text{hot}) \rightarrow y = 1 [\text{acc} = 1/1]$$

$$(x_2 = \text{blue} \wedge x_0 \neq \text{hot} \wedge x_1 < 2.1) \rightarrow y = 0$$

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cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_2 = \text{blue} \wedge x_0 = \text{hot}) \rightarrow y = 1 [\text{acc} = 4/5]$$

$$(x_2 = \text{blue} \wedge x_0 \neq \text{hot} \wedge x_1 < 2.1) \rightarrow y = 0$$

$$(x_2 = \text{blue} \wedge x_0 \neq \text{hot} \wedge x_1 \geq 2.1 \wedge x_1 < 2.6) \rightarrow y = 1$$

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hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_2 = \text{blue} \wedge x_0 = \text{hot}) \rightarrow y = 1 [\text{acc} = 5/8]$$

$$(x_2 = \text{blue} \wedge x_0 \neq \text{hot} \wedge x_1 < 2.1) \rightarrow y = 0$$

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hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_2 = \text{blue} \wedge x_0 = \text{hot}) \rightarrow y = 1 [\text{acc} = 1/1]$$

$$(x_2 = \text{blue} \wedge x_0 \neq \text{hot} \wedge x_1 < 2.1) \rightarrow y = 0$$

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cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_2 = \text{blue} \wedge x_0 = \text{hot}) \rightarrow y = 1 [\text{acc} = 1/1]$$

$$(x_2 = \text{blue} \wedge x_0 \neq \text{hot} \wedge x_1 < 2.1) \rightarrow y = 0 [\text{acc} = 2/4]$$

$$(x_2 = \text{blue} \wedge x_0 \neq \text{hot} \wedge x_1 \geq 2.1 \wedge x_1 < 2.6) \rightarrow y = 1$$

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cold	2	blue	0
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cold	2.2	blue	1
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$$(x_2 = \text{blue} \wedge x_0 \neq \text{hot} \wedge x_1 < 2.1) \rightarrow y = 0 [\text{acc} = 2/4]$$

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hot	3	blue	1
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cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_2 = \text{blue} \wedge x_0 = \text{hot}) \rightarrow y = 1 [\text{acc} = 1/1]$$

$$(x_2 = \text{blue} \wedge x_0 \neq \text{hot} \wedge x_1 < 2.1) \rightarrow y = 0 [\text{acc} = 3/7]$$

$$(x_2 = \text{blue} \wedge x_0 \neq \text{hot} \wedge x_1 \geq 2.1 \wedge x_1 < 2.6) \rightarrow y = 1$$

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hot	3	blue	1
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cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
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cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
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$$(x_2 = \text{blue} \wedge x_0 = \text{hot}) \rightarrow y = 1 [\text{acc} = 1/1]$$

$$(x_2 = \text{blue} \wedge x_1 < 2.1) \rightarrow y = 0 [\text{acc} = 2/4]$$

$$(x_2 = \text{blue} \wedge x_0 \neq \text{hot} \wedge x_1 \geq 2.1 \wedge x_1 < 2.6) \rightarrow y = 1 [\text{acc} = 2/2]$$

$$(x_2 = \text{blue} \wedge x_0 \neq \text{hot} \wedge x_1 \geq 2.6) \rightarrow y = 0$$

$$(x_2 \neq \text{blue} \wedge x_1 < 3.75) \rightarrow y = 1$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 3.75 \wedge x_1 < 5.5) \rightarrow y = 0$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 5.5) \rightarrow y = 1$$

Pruning Decision Rules

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_2 = \text{blue} \wedge x_0 = \text{hot}) \rightarrow y = 1 [\text{acc} = 1/1]$$

$$(x_2 = \text{blue} \wedge x_1 < 2.1) \rightarrow y = 0 [\text{acc} = 2/4]$$

$$(x_2 = \text{blue} \wedge x_0 \neq \text{hot} \wedge x_1 \geq 2.1 \wedge x_1 < 2.6) \rightarrow y = 1 [\text{acc} = 1/1]$$

$$(x_2 = \text{blue} \wedge x_0 \neq \text{hot} \wedge x_1 \geq 2.6) \rightarrow y = 0$$

$$(x_2 \neq \text{blue} \wedge x_1 < 3.75) \rightarrow y = 1$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 3.75 \wedge x_1 < 5.5) \rightarrow y = 0$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 5.5) \rightarrow y = 1$$

Pruning Decision Rules

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_2 = \text{blue} \wedge x_0 = \text{hot}) \rightarrow y = 1 [\text{acc} = 1/1]$$

$$(x_2 = \text{blue} \wedge x_1 < 2.1) \rightarrow y = 0 [\text{acc} = 2/4]$$

$$(x_2 = \text{blue} \wedge x_0 \neq \text{hot} \wedge x_1 \geq 2.1 \wedge x_1 < 2.6) \rightarrow y = 1 [\text{acc} = 3/5]$$

$$(x_2 = \text{blue} \wedge x_0 \neq \text{hot} \wedge x_1 \geq 2.6) \rightarrow y = 0$$

$$(x_2 \neq \text{blue} \wedge x_1 < 3.75) \rightarrow y = 1$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 3.75 \wedge x_1 < 5.5) \rightarrow y = 0$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 5.5) \rightarrow y = 1$$

Pruning Decision Rules

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_2 = \text{blue} \wedge x_0 = \text{hot}) \rightarrow y = 1 [\text{acc} = 1/1]$$

$$(x_2 = \text{blue} \wedge x_1 < 2.1) \rightarrow y = 0 [\text{acc} = 2/4]$$

$$(x_2 = \text{blue} \wedge x_0 \neq \text{hot} \wedge x_1 \geq 2.1 \wedge x_1 < 2.6) \rightarrow y = 1 [\text{acc} = 2/3]$$

$$(x_2 = \text{blue} \wedge x_0 \neq \text{hot} \wedge x_1 \geq 2.6) \rightarrow y = 0$$

$$(x_2 \neq \text{blue} \wedge x_1 < 3.75) \rightarrow y = 1$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 3.75 \wedge x_1 < 5.5) \rightarrow y = 0$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 5.5) \rightarrow y = 1$$

Pruning Decision Rules

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_2 = \text{blue} \wedge x_0 = \text{hot}) \rightarrow y = 1 [\text{acc} = 1/1]$$

$$(x_2 = \text{blue} \wedge x_1 < 2.1) \rightarrow y = 0 [\text{acc} = 2/4]$$

$$(x_2 = \text{blue} \wedge x_1 \geq 2.1 \wedge x_1 < 2.6) \rightarrow y = 1 [\text{acc} = 1/1]$$

$$(x_2 = \text{blue} \wedge x_0 \neq \text{hot} \wedge x_1 \geq 2.6) \rightarrow y = 0$$

$$(x_2 \neq \text{blue} \wedge x_1 < 3.75) \rightarrow y = 1$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 3.75 \wedge x_1 < 5.5) \rightarrow y = 0$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 5.5) \rightarrow y = 1$$

Pruning Decision Rules

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_2 = \text{blue} \wedge x_0 = \text{hot}) \rightarrow y = 1 [\text{acc} = 1/1]$$

$$(x_2 = \text{blue} \wedge x_1 < 2.1) \rightarrow y = 0 [\text{acc} = 2/4]$$

$$(x_2 = \text{blue} \wedge x_1 \geq 2.1 \wedge x_1 < 2.6) \rightarrow y = 1 [\text{acc} = 1/1]$$

$$(x_2 = \text{blue} \wedge x_0 \neq \text{hot} \wedge x_1 \geq 2.6) \rightarrow y = 0$$

$$(x_2 \neq \text{blue} \wedge x_1 < 3.75) \rightarrow y = 1$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 3.75 \wedge x_1 < 5.5) \rightarrow y = 0$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 5.5) \rightarrow y = 1$$

Pruning Decision Rules

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_2 = \text{blue} \wedge x_0 = \text{hot}) \rightarrow y = 1 [\text{acc} = 1/1]$$

$$(x_2 = \text{blue} \wedge x_1 < 2.1) \rightarrow y = 0 [\text{acc} = 2/4]$$

$$(x_2 = \text{blue} \wedge x_1 \geq 2.1 \wedge x_1 < 2.6) \rightarrow y = 1 [\text{acc} = 2/2]$$

$$(x_2 = \text{blue} \wedge x_0 \neq \text{hot} \wedge x_1 \geq 2.6) \rightarrow y = 0$$

$$(x_2 \neq \text{blue} \wedge x_1 < 3.75) \rightarrow y = 1$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 3.75 \wedge x_1 < 5.5) \rightarrow y = 0$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 5.5) \rightarrow y = 1$$

Pruning Decision Rules

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_2 = \text{blue} \wedge x_0 = \text{hot}) \rightarrow y = 1 [\text{acc} = 1/1]$$

$$(x_2 = \text{blue} \wedge x_1 < 2.1) \rightarrow y = 0 [\text{acc} = 2/4]$$

$$(x_2 = \text{blue} \wedge x_1 \geq 2.1 \wedge x_1 < 2.6) \rightarrow y = 1 [\text{acc} = 3/5]$$

$$(x_2 = \text{blue} \wedge x_0 \neq \text{hot} \wedge x_1 \geq 2.6) \rightarrow y = 0$$

$$(x_2 \neq \text{blue} \wedge x_1 < 3.75) \rightarrow y = 1$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 3.75 \wedge x_1 < 5.5) \rightarrow y = 0$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 5.5) \rightarrow y = 1$$

Pruning Decision Rules

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_2 = \text{blue} \wedge x_0 = \text{hot}) \rightarrow y = 1 [\text{acc} = 1/1]$$

$$(x_2 = \text{blue} \wedge x_1 < 2.1) \rightarrow y = 0 [\text{acc} = 2/4]$$

$$(x_2 = \text{blue} \wedge x_1 \geq 2.1 \wedge x_1 < 2.6) \rightarrow y = 1 [\text{acc} = 3/4]$$

$$(x_2 = \text{blue} \wedge x_0 \neq \text{hot} \wedge x_1 \geq 2.6) \rightarrow y = 0$$

$$(x_2 \neq \text{blue} \wedge x_1 < 3.75) \rightarrow y = 1$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 3.75 \wedge x_1 < 5.5) \rightarrow y = 0$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 5.5) \rightarrow y = 1$$

Pruning Decision Rules

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_2 = \text{blue} \wedge x_0 = \text{hot}) \rightarrow y = 1 [\text{acc} = 1/1]$$

$$(x_2 = \text{blue} \wedge x_1 < 2.1) \rightarrow y = 0 [\text{acc} = 2/4]$$

$$(x_1 \geq 2.1 \wedge x_1 < 2.6) \rightarrow y = 1 [\text{acc} = 2/2]$$

$$(x_2 = \text{blue} \wedge x_0 \neq \text{hot} \wedge x_1 \geq 2.6) \rightarrow y = 0$$

$$(x_2 \neq \text{blue} \wedge x_1 < 3.75) \rightarrow y = 1$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 3.75 \wedge x_1 < 5.5) \rightarrow y = 0$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 5.5) \rightarrow y = 1$$

Pruning Decision Rules

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_2 = \text{blue} \wedge x_0 = \text{hot}) \rightarrow y = 1 [\text{acc} = 1/1]$$

$$(x_2 = \text{blue} \wedge x_1 < 2.1) \rightarrow y = 0 [\text{acc} = 2/4]$$

$$(x_1 \geq 2.1 \wedge x_1 < 2.6) \rightarrow y = 1 [\text{acc} = 2/2]$$

$$(x_2 = \text{blue} \wedge x_0 \neq \text{hot} \wedge x_1 \geq 2.6) \rightarrow y = 0$$

$$(x_2 \neq \text{blue} \wedge x_1 < 3.75) \rightarrow y = 1$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 3.75 \wedge x_1 < 5.5) \rightarrow y = 0$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 5.5) \rightarrow y = 1$$

Pruning Decision Rules

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_2 = \text{blue} \wedge x_0 = \text{hot}) \rightarrow y = 1 [\text{acc} = 1/1]$$

$$(x_2 = \text{blue} \wedge x_1 < 2.1) \rightarrow y = 0 [\text{acc} = 2/4]$$

$$(x_1 \geq 2.1 \wedge x_1 < 2.6) \rightarrow y = 1 [\text{acc} = 7/9]$$

$$(x_2 = \text{blue} \wedge x_0 \neq \text{hot} \wedge x_1 \geq 2.6) \rightarrow y = 0$$

$$(x_2 \neq \text{blue} \wedge x_1 < 3.75) \rightarrow y = 1$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 3.75 \wedge x_1 < 5.5) \rightarrow y = 0$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 5.5) \rightarrow y = 1$$

Pruning Decision Rules

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_2 = \text{blue} \wedge x_0 = \text{hot}) \rightarrow y = 1 [\text{acc} = 1/1]$$

$$(x_2 = \text{blue} \wedge x_1 < 2.1) \rightarrow y = 0 [\text{acc} = 2/4]$$

$$(x_1 \geq 2.1 \wedge x_1 < 2.6) \rightarrow y = 1 [\text{acc} = 6/9]$$

$$(x_2 = \text{blue} \wedge x_0 \neq \text{hot} \wedge x_1 \geq 2.6) \rightarrow y = 0$$

$$(x_2 \neq \text{blue} \wedge x_1 < 3.75) \rightarrow y = 1$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 3.75 \wedge x_1 < 5.5) \rightarrow y = 0$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 5.5) \rightarrow y = 1$$

Pruning Decision Rules

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_2 = \text{blue} \wedge x_0 = \text{hot}) \rightarrow y = 1 [\text{acc} = 1/1]$$

$$(x_2 = \text{blue} \wedge x_1 < 2.1) \rightarrow y = 0 [\text{acc} = 2/4]$$

$$(x_1 \geq 2.1 \wedge x_1 < 2.6) \rightarrow y = 1 [\text{acc} = 2/2]$$

$$(x_2 = \text{blue} \wedge x_0 \neq \text{hot} \wedge x_1 \geq 2.6) \rightarrow y = 0$$

$$(x_2 \neq \text{blue} \wedge x_1 < 3.75) \rightarrow y = 1$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 3.75 \wedge x_1 < 5.5) \rightarrow y = 0$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 5.5) \rightarrow y = 1$$

Pruning Decision Rules

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_2 = \text{blue} \wedge x_0 = \text{hot}) \rightarrow y = 1 [\text{acc} = 1/1]$$

$$(x_2 = \text{blue} \wedge x_1 < 2.1) \rightarrow y = 0 [\text{acc} = 2/4]$$

$$(x_1 \geq 2.1 \wedge x_1 < 2.6) \rightarrow y = 1 [\text{acc} = 2/2]$$

$$(x_2 = \text{blue} \wedge x_0 \neq \text{hot} \wedge x_1 \geq 2.6) \rightarrow y = 0 [\text{acc} = 1/2]$$

$$(x_2 \neq \text{blue} \wedge x_1 < 3.75) \rightarrow y = 1$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 3.75 \wedge x_1 < 5.5) \rightarrow y = 0$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 5.5) \rightarrow y = 1$$

Pruning Decision Rules

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_2 = \text{blue} \wedge x_0 = \text{hot}) \rightarrow y = 1 [\text{acc} = 1/1]$$

$$(x_2 = \text{blue} \wedge x_1 < 2.1) \rightarrow y = 0 [\text{acc} = 2/4]$$

$$(x_1 \geq 2.1 \wedge x_1 < 2.6) \rightarrow y = 1 [\text{acc} = 2/2]$$

$$(x_2 = \text{blue} \wedge x_0 \neq \text{hot} \wedge x_1 \geq 2.6) \rightarrow y = 0 [\text{acc} = 2/3]$$

$$(x_2 \neq \text{blue} \wedge x_1 < 3.75) \rightarrow y = 1$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 3.75 \wedge x_1 < 5.5) \rightarrow y = 0$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 5.5) \rightarrow y = 1$$

Pruning Decision Rules

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_2 = \text{blue} \wedge x_0 = \text{hot}) \rightarrow y = 1 [\text{acc} = 1/1]$$

$$(x_2 = \text{blue} \wedge x_1 < 2.1) \rightarrow y = 0 [\text{acc} = 2/4]$$

$$(x_1 \geq 2.1 \wedge x_1 < 2.6) \rightarrow y = 1 [\text{acc} = 2/2]$$

$$(x_2 = \text{blue} \wedge x_0 \neq \text{hot} \wedge x_1 \geq 2.6) \rightarrow y = 0 [\text{acc} = 1/3]$$

$$(x_2 \neq \text{blue} \wedge x_1 < 3.75) \rightarrow y = 1$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 3.75 \wedge x_1 < 5.5) \rightarrow y = 0$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 5.5) \rightarrow y = 1$$

Pruning Decision Rules

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_2 = \text{blue} \wedge x_0 = \text{hot}) \rightarrow y = 1 [\text{acc} = 1/1]$$

$$(x_2 = \text{blue} \wedge x_1 < 2.1) \rightarrow y = 0 [\text{acc} = 2/4]$$

$$(x_1 \geq 2.1 \wedge x_1 < 2.6) \rightarrow y = 1 [\text{acc} = 2/2]$$

$$(x_2 = \text{blue} \wedge x_0 \neq \text{hot} \wedge x_1 \geq 2.6) \rightarrow y = 0 [\text{acc} = 3/7]$$

$$(x_2 \neq \text{blue} \wedge x_1 < 3.75) \rightarrow y = 1$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 3.75 \wedge x_1 < 5.5) \rightarrow y = 0$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 5.5) \rightarrow y = 1$$

Pruning Decision Rules

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_2 = \text{blue} \wedge x_0 = \text{hot}) \rightarrow y = 1 [\text{acc} = 1/1]$$

$$(x_2 = \text{blue} \wedge x_1 < 2.1) \rightarrow y = 0 [\text{acc} = 2/4]$$

$$(x_1 \geq 2.1 \wedge x_1 < 2.6) \rightarrow y = 1 [\text{acc} = 2/2]$$

$$(x_0 \neq \text{hot} \wedge x_1 \geq 2.6) \rightarrow y = 0 [\text{acc} = 2/3]$$

$$(x_2 \neq \text{blue} \wedge x_1 < 3.75) \rightarrow y = 1$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 3.75 \wedge x_1 < 5.5) \rightarrow y = 0$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 5.5) \rightarrow y = 1$$

Pruning Decision Rules

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_2 = \text{blue} \wedge x_0 = \text{hot}) \rightarrow y = 1 [\text{acc} = 1/1]$$

$$(x_2 = \text{blue} \wedge x_1 < 2.1) \rightarrow y = 0 [\text{acc} = 2/4]$$

$$(x_1 \geq 2.1 \wedge x_1 < 2.6) \rightarrow y = 1 [\text{acc} = 2/2]$$

$$(x_0 \neq \text{hot} \wedge x_1 \geq 2.6) \rightarrow y = 0 [\text{acc} = 2/3]$$

$$(x_2 \neq \text{blue} \wedge x_1 < 3.75) \rightarrow y = 1$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 3.75 \wedge x_1 < 5.5) \rightarrow y = 0$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 5.5) \rightarrow y = 1$$

Pruning Decision Rules

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_2 = \text{blue} \wedge x_0 = \text{hot}) \rightarrow y = 1 [\text{acc} = 1/1]$$

$$(x_2 = \text{blue} \wedge x_1 < 2.1) \rightarrow y = 0 [\text{acc} = 2/4]$$

$$(x_1 \geq 2.1 \wedge x_1 < 2.6) \rightarrow y = 1 [\text{acc} = 2/2]$$

$$(x_0 \neq \text{hot} \wedge x_1 \geq 2.6) \rightarrow y = 0 [\text{acc} = 3/7]$$

$$(x_2 \neq \text{blue} \wedge x_1 < 3.75) \rightarrow y = 1$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 3.75 \wedge x_1 < 5.5) \rightarrow y = 0$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 5.5) \rightarrow y = 1$$

Pruning Decision Rules

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_2 = \text{blue} \wedge x_0 = \text{hot}) \rightarrow y = 1 [\text{acc} = 1/1]$$

$$(x_2 = \text{blue} \wedge x_1 < 2.1) \rightarrow y = 0 [\text{acc} = 2/4]$$

$$(x_1 \geq 2.1 \wedge x_1 < 2.6) \rightarrow y = 1 [\text{acc} = 2/2]$$

$$(x_0 \neq \text{hot} \wedge x_1 \geq 2.6) \rightarrow y = 0 [\text{acc} = 4/11]$$

$$(x_2 \neq \text{blue} \wedge x_1 < 3.75) \rightarrow y = 1$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 3.75 \wedge x_1 < 5.5) \rightarrow y = 0$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 5.5) \rightarrow y = 1$$

Pruning Decision Rules

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_2 = \text{blue} \wedge x_0 = \text{hot}) \rightarrow y = 1 [\text{acc} = 1/1]$$

$$(x_2 = \text{blue} \wedge x_1 < 2.1) \rightarrow y = 0 [\text{acc} = 2/4]$$

$$(x_1 \geq 2.1 \wedge x_1 < 2.6) \rightarrow y = 1 [\text{acc} = 2/2]$$

$$(x_0 \neq \text{hot} \wedge x_1 \geq 2.6) \rightarrow y = 0 [\text{acc} = 2/3]$$

$$(x_2 \neq \text{blue} \wedge x_1 < 3.75) \rightarrow y = 1$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 3.75 \wedge x_1 < 5.5) \rightarrow y = 0$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 5.5) \rightarrow y = 1$$

Pruning Decision Rules

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_2 = \text{blue} \wedge x_0 = \text{hot}) \rightarrow y = 1 [\text{acc} = 1/1]$$

$$(x_2 = \text{blue} \wedge x_1 < 2.1) \rightarrow y = 0 [\text{acc} = 2/4]$$

$$(x_1 \geq 2.1 \wedge x_1 < 2.6) \rightarrow y = 1 [\text{acc} = 2/2]$$

$$(x_0 \neq \text{hot} \wedge x_1 \geq 2.6) \rightarrow y = 0 [\text{acc} = 2/3]$$

$$(x_2 \neq \text{blue} \wedge x_1 < 3.75) \rightarrow y = 1 [\text{acc} = 5/5]$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 3.75 \wedge x_1 < 5.5) \rightarrow y = 0$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 5.5) \rightarrow y = 1$$

Pruning Decision Rules

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_2 = \text{blue} \wedge x_0 = \text{hot}) \rightarrow y = 1 [\text{acc} = 1/1]$$

$$(x_2 = \text{blue} \wedge x_1 < 2.1) \rightarrow y = 0 [\text{acc} = 2/4]$$

$$(x_1 \geq 2.1 \wedge x_1 < 2.6) \rightarrow y = 1 [\text{acc} = 2/2]$$

$$(x_0 \neq \text{hot} \wedge x_1 \geq 2.6) \rightarrow y = 0 [\text{acc} = 2/3]$$

$$(x_2 \neq \text{blue} \wedge x_1 < 3.75) \rightarrow y = 1 [\text{acc} = 10/13]$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 3.75 \wedge x_1 < 5.5) \rightarrow y = 0$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 5.5) \rightarrow y = 1$$

Pruning Decision Rules

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_2 = \text{blue} \wedge x_0 = \text{hot}) \rightarrow y = 1 [\text{acc} = 1/1]$$

$$(x_2 = \text{blue} \wedge x_1 < 2.1) \rightarrow y = 0 [\text{acc} = 2/4]$$

$$(x_1 \geq 2.1 \wedge x_1 < 2.6) \rightarrow y = 1 [\text{acc} = 2/2]$$

$$(x_0 \neq \text{hot} \wedge x_1 \geq 2.6) \rightarrow y = 0 [\text{acc} = 2/3]$$

$$(x_2 \neq \text{blue} \wedge x_1 < 3.75) \rightarrow y = 1 [\text{acc} = 6/8]$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 3.75 \wedge x_1 < 5.5) \rightarrow y = 0$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 5.5) \rightarrow y = 1$$

Pruning Decision Rules

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_2 = \text{blue} \wedge x_0 = \text{hot}) \rightarrow y = 1 [\text{acc} = 1/1]$$

$$(x_2 = \text{blue} \wedge x_1 < 2.1) \rightarrow y = 0 [\text{acc} = 2/4]$$

$$(x_1 \geq 2.1 \wedge x_1 < 2.6) \rightarrow y = 1 [\text{acc} = 2/2]$$

$$(x_0 \neq \text{hot} \wedge x_1 \geq 2.6) \rightarrow y = 0 [\text{acc} = 2/3]$$

$$(x_2 \neq \text{blue} \wedge x_1 < 3.75) \rightarrow y = 1 [\text{acc} = 5/5]$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 3.75 \wedge x_1 < 5.5) \rightarrow y = 0$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 5.5) \rightarrow y = 1$$

Pruning Decision Rules

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_2 = \text{blue} \wedge x_0 = \text{hot}) \rightarrow y = 1 [\text{acc} = 1/1]$$

$$(x_2 = \text{blue} \wedge x_1 < 2.1) \rightarrow y = 0 [\text{acc} = 2/4]$$

$$(x_1 \geq 2.1 \wedge x_1 < 2.6) \rightarrow y = 1 [\text{acc} = 2/2]$$

$$(x_0 \neq \text{hot} \wedge x_1 \geq 2.6) \rightarrow y = 0 [\text{acc} = 2/3]$$

$$(x_2 \neq \text{blue} \wedge x_1 < 3.75) \rightarrow y = 1 [\text{acc} = 5/5]$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 3.75 \wedge x_1 < 5.5) \rightarrow y = 0 [\text{acc} = 2/2]$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 5.5) \rightarrow y = 1$$

Pruning Decision Rules

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_2 = \text{blue} \wedge x_0 = \text{hot}) \rightarrow y = 1 [\text{acc} = 1/1]$$

$$(x_2 = \text{blue} \wedge x_1 < 2.1) \rightarrow y = 0 [\text{acc} = 2/4]$$

$$(x_1 \geq 2.1 \wedge x_1 < 2.6) \rightarrow y = 1 [\text{acc} = 2/2]$$

$$(x_0 \neq \text{hot} \wedge x_1 \geq 2.6) \rightarrow y = 0 [\text{acc} = 2/3]$$

$$(x_2 \neq \text{blue} \wedge x_1 < 3.75) \rightarrow y = 1 [\text{acc} = 5/5]$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 3.75 \wedge x_1 < 5.5) \rightarrow y = 0 [\text{acc} = 2/2]$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 5.5) \rightarrow y = 1$$

Pruning Decision Rules

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_2 = \text{blue} \wedge x_0 = \text{hot}) \rightarrow y = 1 [\text{acc} = 1/1]$$

$$(x_2 = \text{blue} \wedge x_1 < 2.1) \rightarrow y = 0 [\text{acc} = 2/4]$$

$$(x_1 \geq 2.1 \wedge x_1 < 2.6) \rightarrow y = 1 [\text{acc} = 2/2]$$

$$(x_0 \neq \text{hot} \wedge x_1 \geq 2.6) \rightarrow y = 0 [\text{acc} = 2/3]$$

$$(x_2 \neq \text{blue} \wedge x_1 < 3.75) \rightarrow y = 1 [\text{acc} = 5/5]$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 3.75 \wedge x_1 < 5.5) \rightarrow y = 0 [\text{acc} = 2/7]$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 5.5) \rightarrow y = 1$$

Pruning Decision Rules

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_2 = \text{blue} \wedge x_0 = \text{hot}) \rightarrow y = 1 [\text{acc} = 1/1]$$

$$(x_2 = \text{blue} \wedge x_1 < 2.1) \rightarrow y = 0 [\text{acc} = 2/4]$$

$$(x_1 \geq 2.1 \wedge x_1 < 2.6) \rightarrow y = 1 [\text{acc} = 2/2]$$

$$(x_0 \neq \text{hot} \wedge x_1 \geq 2.6) \rightarrow y = 0 [\text{acc} = 2/3]$$

$$(x_2 \neq \text{blue} \wedge x_1 < 3.75) \rightarrow y = 1 [\text{acc} = 5/5]$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 3.75 \wedge x_1 < 5.5) \rightarrow y = 0 [\text{acc} = 2/3]$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 5.5) \rightarrow y = 1$$

Pruning Decision Rules

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_2 = \text{blue} \wedge x_0 = \text{hot}) \rightarrow y = 1 [\text{acc} = 1/1]$$

$$(x_2 = \text{blue} \wedge x_1 < 2.1) \rightarrow y = 0 [\text{acc} = 2/4]$$

$$(x_1 \geq 2.1 \wedge x_1 < 2.6) \rightarrow y = 1 [\text{acc} = 2/2]$$

$$(x_0 \neq \text{hot} \wedge x_1 \geq 2.6) \rightarrow y = 0 [\text{acc} = 2/3]$$

$$(x_2 \neq \text{blue} \wedge x_1 < 3.75) \rightarrow y = 1 [\text{acc} = 5/5]$$

$$(x_1 \geq 3.75 \wedge x_1 < 5.5) \rightarrow y = 0 [\text{acc} = 2/2]$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 5.5) \rightarrow y = 1$$

Pruning Decision Rules

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_2 = \text{blue} \wedge x_0 = \text{hot}) \rightarrow y = 1 [\text{acc} = 1/1]$$

$$(x_2 = \text{blue} \wedge x_1 < 2.1) \rightarrow y = 0 [\text{acc} = 2/4]$$

$$(x_1 \geq 2.1 \wedge x_1 < 2.6) \rightarrow y = 1 [\text{acc} = 2/2]$$

$$(x_0 \neq \text{hot} \wedge x_1 \geq 2.6) \rightarrow y = 0 [\text{acc} = 2/3]$$

$$(x_2 \neq \text{blue} \wedge x_1 < 3.75) \rightarrow y = 1 [\text{acc} = 5/5]$$

$$(x_1 \geq 3.75 \wedge x_1 < 5.5) \rightarrow y = 0 [\text{acc} = 2/2]$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 5.5) \rightarrow y = 1$$

Pruning Decision Rules

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_2 = \text{blue} \wedge x_0 = \text{hot}) \rightarrow y = 1 [\text{acc} = 1/1]$$

$$(x_2 = \text{blue} \wedge x_1 < 2.1) \rightarrow y = 0 [\text{acc} = 2/4]$$

$$(x_1 \geq 2.1 \wedge x_1 < 2.6) \rightarrow y = 1 [\text{acc} = 2/2]$$

$$(x_0 \neq \text{hot} \wedge x_1 \geq 2.6) \rightarrow y = 0 [\text{acc} = 2/3]$$

$$(x_2 \neq \text{blue} \wedge x_1 < 3.75) \rightarrow y = 1 [\text{acc} = 5/5]$$

$$(x_1 \geq 3.75 \wedge x_1 < 5.5) \rightarrow y = 0 [\text{acc} = 5/15]$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 5.5) \rightarrow y = 1$$

Pruning Decision Rules

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_2 = \text{blue} \wedge x_0 = \text{hot}) \rightarrow y = 1 [\text{acc} = 1/1]$$

$$(x_2 = \text{blue} \wedge x_1 < 2.1) \rightarrow y = 0 [\text{acc} = 2/4]$$

$$(x_1 \geq 2.1 \wedge x_1 < 2.6) \rightarrow y = 1 [\text{acc} = 2/2]$$

$$(x_0 \neq \text{hot} \wedge x_1 \geq 2.6) \rightarrow y = 0 [\text{acc} = 2/3]$$

$$(x_2 \neq \text{blue} \wedge x_1 < 3.75) \rightarrow y = 1 [\text{acc} = 5/5]$$

$$(x_1 \geq 3.75 \wedge x_1 < 5.5) \rightarrow y = 0 [\text{acc} = 2/3]$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 5.5) \rightarrow y = 1$$

Pruning Decision Rules

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_2 = \text{blue} \wedge x_0 = \text{hot}) \rightarrow y = 1 [\text{acc} = 1/1]$$

$$(x_2 = \text{blue} \wedge x_1 < 2.1) \rightarrow y = 0 [\text{acc} = 2/4]$$

$$(x_1 \geq 2.1 \wedge x_1 < 2.6) \rightarrow y = 1 [\text{acc} = 2/2]$$

$$(x_0 \neq \text{hot} \wedge x_1 \geq 2.6) \rightarrow y = 0 [\text{acc} = 2/3]$$

$$(x_2 \neq \text{blue} \wedge x_1 < 3.75) \rightarrow y = 1 [\text{acc} = 5/5]$$

$$(x_1 \geq 3.75 \wedge x_1 < 5.5) \rightarrow y = 0 [\text{acc} = 2/2]$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 5.5) \rightarrow y = 1$$

Pruning Decision Rules

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_2 = \text{blue} \wedge x_0 = \text{hot}) \rightarrow y = 1 [\text{acc} = 1/1]$$

$$(x_2 = \text{blue} \wedge x_1 < 2.1) \rightarrow y = 0 [\text{acc} = 2/4]$$

$$(x_1 \geq 2.1 \wedge x_1 < 2.6) \rightarrow y = 1 [\text{acc} = 2/2]$$

$$(x_0 \neq \text{hot} \wedge x_1 \geq 2.6) \rightarrow y = 0 [\text{acc} = 2/3]$$

$$(x_2 \neq \text{blue} \wedge x_1 < 3.75) \rightarrow y = 1 [\text{acc} = 5/5]$$

$$(x_1 \geq 3.75 \wedge x_1 < 5.5) \rightarrow y = 0 [\text{acc} = 2/2]$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 5.5) \rightarrow y = 1 [\text{acc} = 1/1]$$

Pruning Decision Rules

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_2 = \text{blue} \wedge x_0 = \text{hot}) \rightarrow y = 1 [\text{acc} = 1/1]$$

$$(x_2 = \text{blue} \wedge x_1 < 2.1) \rightarrow y = 0 [\text{acc} = 2/4]$$

$$(x_1 \geq 2.1 \wedge x_1 < 2.6) \rightarrow y = 1 [\text{acc} = 2/2]$$

$$(x_0 \neq \text{hot} \wedge x_1 \geq 2.6) \rightarrow y = 0 [\text{acc} = 2/3]$$

$$(x_2 \neq \text{blue} \wedge x_1 < 3.75) \rightarrow y = 1 [\text{acc} = 5/5]$$

$$(x_1 \geq 3.75 \wedge x_1 < 5.5) \rightarrow y = 0 [\text{acc} = 2/2]$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 5.5) \rightarrow y = 1 [\text{acc} = 1/1]$$

Pruning Decision Rules

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_2 = \text{blue} \wedge x_0 = \text{hot}) \rightarrow y = 1 [\text{acc} = 1/1]$$

$$(x_2 = \text{blue} \wedge x_1 < 2.1) \rightarrow y = 0 [\text{acc} = 2/4]$$

$$(x_1 \geq 2.1 \wedge x_1 < 2.6) \rightarrow y = 1 [\text{acc} = 2/2]$$

$$(x_0 \neq \text{hot} \wedge x_1 \geq 2.6) \rightarrow y = 0 [\text{acc} = 2/3]$$

$$(x_2 \neq \text{blue} \wedge x_1 < 3.75) \rightarrow y = 1 [\text{acc} = 5/5]$$

$$(x_1 \geq 3.75 \wedge x_1 < 5.5) \rightarrow y = 0 [\text{acc} = 2/2]$$

$$(x_2 \neq \text{blue} \wedge x_1 \geq 5.5) \rightarrow y = 1 [\text{acc} = 6/8]$$

Pruning Decision Rules

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_2 = \text{blue} \wedge x_0 = \text{hot}) \rightarrow y = 1 [\text{acc} = 1/1]$$

$$(x_2 = \text{blue} \wedge x_1 < 2.1) \rightarrow y = 0 [\text{acc} = 2/4]$$

$$(x_1 \geq 2.1 \wedge x_1 < 2.6) \rightarrow y = 1 [\text{acc} = 2/2]$$

$$(x_0 \neq \text{hot} \wedge x_1 \geq 2.6) \rightarrow y = 0 [\text{acc} = 2/3]$$

$$(x_2 \neq \text{blue} \wedge x_1 < 3.75) \rightarrow y = 1 [\text{acc} = 5/5]$$

$$(x_1 \geq 3.75 \wedge x_1 < 5.5) \rightarrow y = 0 [\text{acc} = 2/2]$$

$$(x_1 \geq 5.5) \rightarrow y = 1 [\text{acc} = 1/1]$$

Pruning Decision Rules

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_2 = \text{blue} \wedge x_0 = \text{hot}) \rightarrow y = 1 [\text{acc} = 1/1]$$

$$(x_2 = \text{blue} \wedge x_1 < 2.1) \rightarrow y = 0 [\text{acc} = 2/4]$$

$$(x_1 \geq 2.1 \wedge x_1 < 2.6) \rightarrow y = 1 [\text{acc} = 2/2]$$

$$(x_0 \neq \text{hot} \wedge x_1 \geq 2.6) \rightarrow y = 0 [\text{acc} = 2/3]$$

$$(x_2 \neq \text{blue} \wedge x_1 < 3.75) \rightarrow y = 1 [\text{acc} = 5/5]$$

$$(x_1 \geq 3.75 \wedge x_1 < 5.5) \rightarrow y = 0 [\text{acc} = 2/2]$$

$$(x_1 \geq 5.5) \rightarrow y = 1 [\text{acc} = 1/1]$$

Pruning Decision Rules

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_2 = \text{blue} \wedge x_0 = \text{hot}) \rightarrow y = 1 [\text{acc} = 1/1]$$

$$(x_2 = \text{blue} \wedge x_1 < 2.1) \rightarrow y = 0 [\text{acc} = 2/4]$$

$$(x_1 \geq 2.1 \wedge x_1 < 2.6) \rightarrow y = 1 [\text{acc} = 2/2]$$

$$(x_0 \neq \text{hot} \wedge x_1 \geq 2.6) \rightarrow y = 0 [\text{acc} = 2/3]$$

$$(x_2 \neq \text{blue} \wedge x_1 < 3.75) \rightarrow y = 1 [\text{acc} = 5/5]$$

$$(x_1 \geq 3.75 \wedge x_1 < 5.5) \rightarrow y = 0 [\text{acc} = 2/2]$$

$$(x_1 \geq 5.5) \rightarrow y = 1 [\text{acc} = 11/16]$$

Pruning Decision Rules

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_2 = \text{blue} \wedge x_0 = \text{hot}) \rightarrow y = 1 [\text{acc} = 1/1]$$

$$(x_2 = \text{blue} \wedge x_1 < 2.1) \rightarrow y = 0 [\text{acc} = 2/4]$$

$$(x_1 \geq 2.1 \wedge x_1 < 2.6) \rightarrow y = 1 [\text{acc} = 2/2]$$

$$(x_0 \neq \text{hot} \wedge x_1 \geq 2.6) \rightarrow y = 0 [\text{acc} = 2/3]$$

$$(x_2 \neq \text{blue} \wedge x_1 < 3.75) \rightarrow y = 1 [\text{acc} = 5/5]$$

$$(x_1 \geq 3.75 \wedge x_1 < 5.5) \rightarrow y = 0 [\text{acc} = 2/2]$$

$$(x_1 \geq 5.5) \rightarrow y = 1 [\text{acc} = 1/1]$$

Pruning Decision Rules

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_2 \neq \text{blue} \wedge x_1 < 3.75) \rightarrow y = 1 [\text{acc} = 5/5]$$

$$(x_1 \geq 2.1 \wedge x_1 < 2.6) \rightarrow y = 1 [\text{acc} = 2/2]$$

$$(x_1 \geq 3.75 \wedge x_1 < 5.5) \rightarrow y = 0 [\text{acc} = 2/2]$$

$$(x_2 = \text{blue} \wedge x_0 = \text{hot}) \rightarrow y = 1 [\text{acc} = 1/1]$$

$$(x_1 \geq 5.5) \rightarrow y = 1 [\text{acc} = 1/1]$$

$$(x_0 \neq \text{hot} \wedge x_1 \geq 2.6) \rightarrow y = 0 [\text{acc} = 2/3]$$

$$(x_2 = \text{blue} \wedge x_1 < 2.1) \rightarrow y = 0 [\text{acc} = 2/4]$$

Rule Set Generation

- Infer a rule set, perhaps by
 - ▶ Learning a Decision Tree
 - ▶ Converting each leaf to a rule
- Prune each rule by removing any preconditions that result not degrading its accuracy on the training set.
- Sort the pruned rules by their estimated accuracy.

When evaluating a rule set:
Consider them in order when classifying a new instance.
Use the first matching rule!

Why Prune Rule Set

Why prune a rule set, instead of the decision tree?

- Converting allows to remove conditions in the “middle” of the tree.
- Converting allows the removal of conditions for some leaves, but not for others.
- Sometimes rule sets are easier for people to understand.

Learn Rule Set

Why not learn the rule set directly?

Why not learn the rule set directly?

Sequential Covering Algorithm:

- $\text{Rules} \leftarrow \{\}$
- While not done:
 - ▶ $\text{NewRule} \leftarrow \text{Learn-one-rule}(\text{Data})$
 - ▶ $\text{Rules} \leftarrow \text{Rules} + \text{NewRule}$
 - ▶ $\text{Data} \leftarrow \text{Data} - (\text{Examples correctly classified by NewRule})$
- Sort Rules by **Performance** over full Data

Why not learn the rule set directly?

Sequential Covering Algorithm:

- Rules $\leftarrow \{\}$
- While not done:
 - ▶ NewRule \leftarrow **Learn-one-rule**(Data)
 - ▶ Rules \leftarrow Rules + NewRule
 - ▶ Data \leftarrow Data - (Examples correctly classified by NewRule)
- Sort Rules by **Performance** over full Data

Performance could be any of the measures used in decision tree learning:

- mis-classification rate
- Gini index
- Entropy

Learn One Rule

- $\text{Rule} \leftarrow \{\}$
- $\text{Bestrule} \leftarrow \text{Rule}$
- While rule can be made more specific:
 - ▶ Let C be the condition that, when added to Rule, makes **Performance** (Rule) best
 - ▶ $\text{Rule} \leftarrow \text{Rule} \wedge C$
 - ▶ If **Performance**(Rule) better than **Performance**(Bestrule):
 - ▶ $\text{Bestrule} \leftarrow \text{Rule}$

Learn One Rule

- $\text{Rule} \leftarrow \{\}$
- $\text{Bestrule} \leftarrow \text{Rule}$
- While rule can be made more specific:
 - ▶ Let C be the condition that, when added to Rule, makes **Performance** (Rule) best
 - ▶ $\text{Rule} \leftarrow \text{Rule} \wedge C$
 - ▶ If **Performance**(Rule) better than **Performance**(Bestrule):
 - ▶ $\text{Bestrule} \leftarrow \text{Rule}$

This is a purely greedy algorithm.

Often, we would use a *Beam Search* instead.

Learning Rule Set

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

Learning Rule Set

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_0 = \text{hot}) \rightarrow y = 1 [\text{acc} = 4/5]$$

Learning Rule Set

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_0 \neq \text{hot}) \rightarrow y = 1 [\text{acc} = 7/11]$$

Learning Rule Set

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_0 = \text{cold}) \rightarrow y = 1 [\text{acc} = 7/11]$$

Learning Rule Set

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_0 \neq \text{cold}) \rightarrow y = 1 [\text{acc} = 4/5]$$

Learning Rule Set

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_1 \geq 1.25) \rightarrow y = 1 [\text{acc} = 10/15]$$

Learning Rule Set

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_1 < 1.65) \rightarrow y = 1 [\text{acc} = 2/3]$$

Learning Rule Set

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_1 \geq 1.65) \rightarrow y = 1 [\text{acc} = 9/13]$$

Learning Rule Set

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_1 < 1.9) \rightarrow y = 1 [\text{acc} = 4/5]$$

Learning Rule Set

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_1 \geq 1.9) \rightarrow y = 1 [\text{acc} = 7/11]$$

Learning Rule Set

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_1 < 2.1) \rightarrow y = 1 [\text{acc} = 5/7]$$

Learning Rule Set

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_1 \geq 2.1) \rightarrow y = 1 [\text{acc} = 6/9]$$

Learning Rule Set

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_1 < 2.25) \rightarrow y = 1 [\text{acc} = 6/8]$$

Learning Rule Set

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_1 \geq 2.25) \rightarrow y = 1 [\text{acc} = 5/8]$$

Learning Rule Set

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_1 < 2.65) \rightarrow y = 1 [\text{acc} = 7/9]$$

Learning Rule Set

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_1 \geq 2.65) \rightarrow y = 1 [\text{acc} = 4/7]$$

Learning Rule Set

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_1 < 3.05) \rightarrow y = 1 [\text{acc} = 9/12]$$

Learning Rule Set

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_1 \geq 3.05) \rightarrow y = 0 [\text{acc} = 2/4]$$

Learning Rule Set

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_1 < 3.8) \rightarrow y = 1 [\text{acc} = 10/13]$$

Learning Rule Set

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_1 \geq 3.8) \rightarrow y = 0 [\text{acc} = 2/3]$$

Learning Rule Set

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_1 < 4.9) \rightarrow y = 1 [\text{acc} = 10/14]$$

Learning Rule Set

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_1 < 5.9) \rightarrow y = 1 [\text{acc} = 10/15]$$

Learning Rule Set

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_2 = \text{red}) \rightarrow y = 1 [\text{acc} = 4/5]$$

Learning Rule Set

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_2 \neq \text{red}) \rightarrow y = 1 [\text{acc} = 7/11]$$

Learning Rule Set

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_2 = \text{green}) \rightarrow y = 1 [\text{acc} = 2/3]$$

Learning Rule Set

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_2 \neq \text{green}) \rightarrow y = 1 [\text{acc} = 9/13]$$

Learning Rule Set

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_2 = \text{blue}) \rightarrow y = 1 [\text{acc} = 5/8]$$

Learning Rule Set

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_2 \neq \text{blue}) \rightarrow y = 1 [\text{acc} = 6/8]$$

Learning Rule Set

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_0 = \text{hot}) \rightarrow y = 1 [\text{acc} = 4/5]$$

Learning Rule Set

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_0 = \text{hot} \wedge x_1 \geq 2) \rightarrow y = 1 [\text{acc} = 3/4]$$

Learning Rule Set

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_0 = \text{hot} \wedge x_1 < 3.75) \rightarrow y = 1 [\text{acc} = 3/3]$$

Learning Rule Set

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_0 = \text{hot} \wedge x_1 < 5.5) \rightarrow y = 1 [\text{acc} = 3/4]$$

Learning Rule Set

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_0 = \text{hot} \wedge x_2 = \text{red}) \rightarrow y = 1 [\text{acc} = 2/3]$$

Learning Rule Set

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_0 = \text{hot} \wedge x_2 \neq \text{green}) \rightarrow y = 1 [\text{acc} = 3/4]$$

Learning Rule Set

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_0 = \text{hot} \wedge x_2 \neq \text{blue}) \rightarrow y = 1 [\text{acc} = 3/4]$$

Learning Rule Set

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_0 = \text{hot} \wedge x_1 < 3.75) \rightarrow y = 1 [\text{acc} = 3/3]$$

Learning Rule Set

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_0 = \text{hot} \wedge x_1 < 3.75) \rightarrow y = 1 [\text{acc} = 3/3]$$

Learning Rule Set

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_0 = \text{hot} \wedge x_1 < 3.75) \rightarrow y = 1 [\text{acc} = 3/3]$$

$$(x_1 < 2.65) \rightarrow y = 1 [\text{acc} = 6/8]$$

Learning Rule Set

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_0 = \text{hot} \wedge x_1 < 3.75) \rightarrow y = 1 [\text{acc} = 3/3]$$

$$(x_1 < 2.65 \wedge x_2 \neq \text{blue}) \rightarrow y = 1 [\text{acc} = 3/3]$$

Learning Rule Set

x_0	x_1	x_2	y
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_0 = \text{hot} \wedge x_1 < 3.75) \rightarrow y = 1 [\text{acc} = 3/3]$$

$$(x_1 < 2.65 \wedge x_2 \neq \text{blue}) \rightarrow y = 1 [\text{acc} = 3/3]$$

Learning Rule Set

x_0	x_1	x_2	y
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_0 = \text{hot} \wedge x_1 < 3.75) \rightarrow y = 1 [\text{acc} = 3/3]$$

$$(x_1 < 2.65 \wedge x_2 \neq \text{blue}) \rightarrow y = 1 [\text{acc} = 3/3]$$

$$(x_1 < 1.9) \rightarrow y = 1 [\text{acc} = 2/3]$$

Learning Rule Set

x_0	x_1	x_2	y
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_0 = \text{hot} \wedge x_1 < 3.75) \rightarrow y = 1 [\text{acc} = 3/3]$$

$$(x_1 < 2.65 \wedge x_2 \neq \text{blue}) \rightarrow y = 1 [\text{acc} = 3/3]$$

$$(x_1 < 1.9) \rightarrow y = 1 [\text{acc} = 2/3]$$

Learning Rule Set

x_0	x_1	x_2	y
hot	4.5	red	0
hot	6.5	green	1
cold	3	blue	0
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1

$$(x_0 = \text{hot} \wedge x_1 < 3.75) \rightarrow y = 1 [\text{acc} = 3/3]$$

$$(x_1 < 2.65 \wedge x_2 \neq \text{blue}) \rightarrow y = 1 [\text{acc} = 3/3]$$

$$(x_1 < 1.9) \rightarrow y = 1 [\text{acc} = 2/3]$$

Learning Rule Set

x_0	x_1	x_2	y
hot	4.5	red	0
hot	6.5	green	1
cold	3	blue	0
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1

$$(x_0 = \text{hot} \wedge x_1 < 3.75) \rightarrow y = 1 [\text{acc} = 3/3]$$

$$(x_1 < 2.65 \wedge x_2 \neq \text{blue}) \rightarrow y = 1 [\text{acc} = 3/3]$$

$$(x_1 < 1.9) \rightarrow y = 1 [\text{acc} = 2/3]$$

$$(x_1 < 5.9) \rightarrow y = 0 [\text{acc} = 4/6]$$

Learning Rule Set

x_0	x_1	x_2	y
hot	4.5	red	0
hot	6.5	green	1
cold	3	blue	0
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1

$$(x_0 = \text{hot} \wedge x_1 < 3.75) \rightarrow y = 1 [\text{acc} = 3/3]$$

$$(x_1 < 2.65 \wedge x_2 \neq \text{blue}) \rightarrow y = 1 [\text{acc} = 3/3]$$

$$(x_1 < 1.9) \rightarrow y = 1 [\text{acc} = 2/3]$$

$$(x_1 < 5.9 \wedge x_1 \geq 2.6) \rightarrow y = 0 [\text{acc} = 3/4]$$

Learning Rule Set

x_0	x_1	x_2	y
hot	4.5	red	0
hot	6.5	green	1
cold	3	blue	0
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1

$$(x_0 = \text{hot} \wedge x_1 < 3.75) \rightarrow y = 1 [\text{acc} = 3/3]$$

$$(x_1 < 2.65 \wedge x_2 \neq \text{blue}) \rightarrow y = 1 [\text{acc} = 3/3]$$

$$(x_1 < 1.9) \rightarrow y = 1 [\text{acc} = 2/3]$$

$$(x_1 < 5.9 \wedge x_1 \geq 2.6 \wedge x_0 \neq \text{hot}) \rightarrow y = 0 [\text{acc} = 2/3]$$

Learning Rule Set

x_0	x_1	x_2	y
hot	4.5	red	0
hot	6.5	green	1
cold	3	blue	0
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1

$$(x_0 = \text{hot} \wedge x_1 < 3.75) \rightarrow y = 1 [\text{acc} = 3/3]$$

$$(x_1 < 2.65 \wedge x_2 \neq \text{blue}) \rightarrow y = 1 [\text{acc} = 3/3]$$

$$(x_1 < 1.9) \rightarrow y = 1 [\text{acc} = 2/3]$$

$$(x_1 < 5.9 \wedge x_1 \geq 2.6 \wedge x_0 \neq \text{hot}) \rightarrow y = 0 [\text{acc} = 2/3]$$

Learning Rule Set

x_0	x_1	x_2	y
hot	4.5	red	0
hot	6.5	green	1
cold	2	blue	0
cold	2.2	blue	1

$$(x_0 = \text{hot} \wedge x_1 < 3.75) \rightarrow y = 1 [\text{acc} = 3/3]$$

$$(x_1 < 2.65 \wedge x_2 \neq \text{blue}) \rightarrow y = 1 [\text{acc} = 3/3]$$

$$(x_1 < 1.9) \rightarrow y = 1 [\text{acc} = 2/3]$$

$$(x_1 < 5.9 \wedge x_1 \geq 2.6 \wedge x_0 \neq \text{hot}) \rightarrow y = 0 [\text{acc} = 2/3]$$

Learning Rule Set

x_0	x_1	x_2	y
hot	4.5	red	0
hot	6.5	green	1
cold	2	blue	0
cold	2.2	blue	1

$$(x_0 = \text{hot} \wedge x_1 < 3.75) \rightarrow y = 1 [\text{acc} = 3/3]$$

$$(x_1 < 2.65 \wedge x_2 \neq \text{blue}) \rightarrow y = 1 [\text{acc} = 3/3]$$

$$(x_1 < 1.9) \rightarrow y = 1 [\text{acc} = 2/3]$$

$$(x_1 < 5.9 \wedge x_1 \geq 2.6 \wedge x_0 \neq \text{hot}) \rightarrow y = 0 [\text{acc} = 2/3]$$

$$(x_1 \geq 2.1) \rightarrow y = 1 [\text{acc} = 2/3]$$

Learning Rule Set

x_0	x_1	x_2	y
hot	4.5	red	0
hot	6.5	green	1
cold	2	blue	0
cold	2.2	blue	1

$$(x_0 = \text{hot} \wedge x_1 < 3.75) \rightarrow y = 1 [\text{acc} = 3/3]$$

$$(x_1 < 2.65 \wedge x_2 \neq \text{blue}) \rightarrow y = 1 [\text{acc} = 3/3]$$

$$(x_1 < 1.9) \rightarrow y = 1 [\text{acc} = 2/3]$$

$$(x_1 < 5.9 \wedge x_1 \geq 2.6 \wedge x_0 \neq \text{hot}) \rightarrow y = 0 [\text{acc} = 2/3]$$

$$(x_1 \geq 2.1) \rightarrow y = 1 [\text{acc} = 2/3]$$

Learning Rule Set

x_0	x_1	x_2	y
cold	2	blue	0

$$(x_0 = \text{hot} \wedge x_1 < 3.75) \rightarrow y = 1[\text{acc} = 3/3]$$

$$(x_1 < 2.65 \wedge x_2 \neq \text{blue}) \rightarrow y = 1 [\text{acc} = 3/3]$$

$$(x_1 < 1.9) \rightarrow y = 1 [\text{acc} = 2/3]$$

$$(x_1 < 5.9 \wedge x_1 \geq 2.6 \wedge x_0 \neq \text{hot}) \rightarrow y = 0 [\text{acc} = 2/3]$$

$$(x_1 \geq 2.1) \rightarrow y = 1 [\text{acc} = 2/3]$$

Learning Rule Set

$$\begin{bmatrix} x_0 & x_1 & x_2 & y \\ \vdots & \vdots & \vdots & \vdots \\ \text{cold} & 2 & \text{blue} & 0 \end{bmatrix}$$

$$(x_0 = \text{hot} \wedge x_1 < 3.75) \rightarrow y = 1[\text{acc} = 3/3]$$

$$(x_1 < 2.65 \wedge x_2 \neq \text{blue}) \rightarrow y = 1 [\text{acc} = 3/3]$$

$$(x_1 < 1.9) \rightarrow y = 1 [\text{acc} = 2/3]$$

$$(x_1 < 5.9 \wedge x_1 \geq 2.6 \wedge x_0 \neq \text{hot}) \rightarrow y = 0 [\text{acc} = 2/3]$$

$$(x_1 \geq 2.1) \rightarrow y = 1 [\text{acc} = 2/3]$$

$$() \rightarrow y = 0[\text{acc} = 1/1]$$

Learning Rule Set

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_0 = \text{hot} \wedge x_1 < 3.75) \rightarrow y = 1 [\text{acc} = 3/3]$$

$$(x_1 < 2.65 \wedge x_2 \neq \text{blue}) \rightarrow y = 1 [\text{acc} = 4/4]$$

$$(x_1 < 1.9) \rightarrow y = 1 [\text{acc} = 4/5]$$

$$(x_1 < 5.9 \wedge x_1 \geq 2.6 \wedge x_0 \neq \text{hot}) \rightarrow y = 0 [\text{acc} = 2/3]$$

$$(x_1 \geq 2.1) \rightarrow y = 1 [\text{acc} = 6/9]$$

$$() \rightarrow y = 0 [\text{acc} = 5/16]$$

Learning Rule Set

x_0	x_1	x_2	y
cold	2	red	1
cold	2.3	green	1
hot	1	red	1
hot	4.5	red	0
cold	1.5	blue	0
hot	6.5	green	1
cold	3	blue	0
hot	3	blue	1
cold	3.1	blue	1
cold	5.3	green	0
cold	2	blue	0
cold	2.2	blue	1
hot	3	red	1
cold	1.5	red	1
cold	1.8	blue	1
cold	1.8	blue	1

$$(x_1 < 2.65 \wedge x_2 \neq \text{blue}) \rightarrow y = 1 [\text{acc} = 4/4]$$

$$(x_0 = \text{hot} \wedge x_1 < 3.75) \rightarrow y = 1 [\text{acc} = 3/3]$$

$$(x_1 < 1.9) \rightarrow y = 1 [\text{acc} = 4/5]$$

$$(x_1 \geq 2.1) \rightarrow y = 1 [\text{acc} = 6/9]$$

$$(x_1 < 5.9 \wedge x_1 \geq 2.6 \wedge x_0 \neq \text{hot}) \rightarrow y = 0 [\text{acc} = 2/3]$$

$$() \rightarrow y = 0 [\text{acc} = 5/16]$$