

Machine Learning

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In-Class Exercises

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Consider the following concept learning task: *PlayTennis*:

The data set X contains possible days, each x in X is described by the attributes

- *Outlook*: {Sunny, Overcast, Rain}
- *Temperature*: {Hot, Mild, Cool}
- *Humidity*: {High, Normal}
- *Wind*: {Strong, Weak}

TARGET CONCEPT

- ◆ *PlayTennis*: {Yes, No}

Each hypothesis h in H is described by a conjunction of constraints on attributes *Outlook*, *Temperature*, *Humidity*, and *Wind*. The constraints may be:

- specified by a single required value for this attribute (e.g., *Sunny* for attribute *Outlook*),
- indicated by a “?” that any value is acceptable for this attribute, or
- indicated by a “ \emptyset ” that no value is acceptable.

(I) Answer the following questions.

- (a) How many attributes are there in this data set?
- (b) How many distinct instances are possible in X ?
- (c) How many syntactically distinct hypotheses are in H ?
- (d) How many semantically distinct hypotheses are in H ?

(II) Given the following expressions:

- (1) (*Sunny*, ?, ?, ?)
- (2) (?, *Cool*, *Normal*, ?)
- (3) (*Sunny*, *Cool*, ?, *Strong*)
- (4) (?, ?, ?, *Strong*)
- (5) (?, *Mild*, ?, *Strong*)

(a) Which of expressions (1) through (5) are more general than or equal to (*Sunny*, ?, ?, *Strong*)?

(b) Which of expressions (1) through (5) are more specific than or equal to (?, ?, ?, *Strong*)?

Consider the following concept learning task: ***PlayTennis***:

The data set X contains possible days, each x in X is described by the attributes

- ***Outlook***: {Sunny, Overcast, Rain}
- ***Temperature***: {Hot, Mild, Cool}
- ***Humidity***: {High, Normal}
- ***Wind***: {Strong, Weak}

TARGET CONCEPT

- ◆ ***PlayTennis***: {Yes, No}

(III) Show your work to trace the *Candidate-elimination algorithm* for the following training examples.

<i>Example</i>	<i>Outlook</i>	<i>Temperature</i>	<i>Humidity</i>	<i>Wind</i>	<i>PlayTennis</i>
Day 1	Overcast	Mild	Normal	Weak	Yes
Day 2	Sunny	Hot	High	Strong	No
Day 3	Overcast	Mild	High	Weak	Yes
Day 4	Overcast	Cool	High	Weak	Yes