

Apprendimento Automatico

Fabio Aioli

www.math.unipd.it/~aioli

Sito web del corso

www.math.unipd.it/~aioli/corsi/1617/aa/aa.html

Apprendimento di Concetti (1)

Example	<i>Sky</i>	<i>AirTemp</i>	<i>Humidity</i>	<i>Wind</i>	<i>Water</i>	<i>Forecast</i>	<i>EnjoySport</i>
1	Sunny	Warm	Normal	Strong	Warm	Same	Yes
2	Sunny	Warm	High	Strong	Warm	Same	Yes
3	Rainy	Cold	High	Strong	Warm	Change	No
4	Sunny	Warm	High	Strong	Cool	Change	Yes

- **Given:**

- Instances X : Possible days, each described by the attributes
 - *Sky* (with possible values *Sunny*, *Cloudy*, and *Rainy*),
 - *AirTemp* (with values *Warm* and *Cold*),
 - *Humidity* (with values *Normal* and *High*),
 - *Wind* (with values *Strong* and *Weak*),
 - *Water* (with values *Warm* and *Cool*), and
 - *Forecast* (with values *Same* and *Change*).
- Hypotheses H : Each hypothesis is described by a conjunction of constraints on the attributes *Sky*, *AirTemp*, *Humidity*, *Wind*, *Water*, and *Forecast*. The constraints may be “?” (any value is acceptable), “ \emptyset ” (no value is acceptable), or a specific value.
- Target concept c : $EnjoySport : X \rightarrow \{0, 1\}$
- Training examples D : Positive and negative examples of the target function (see Table 2.1).

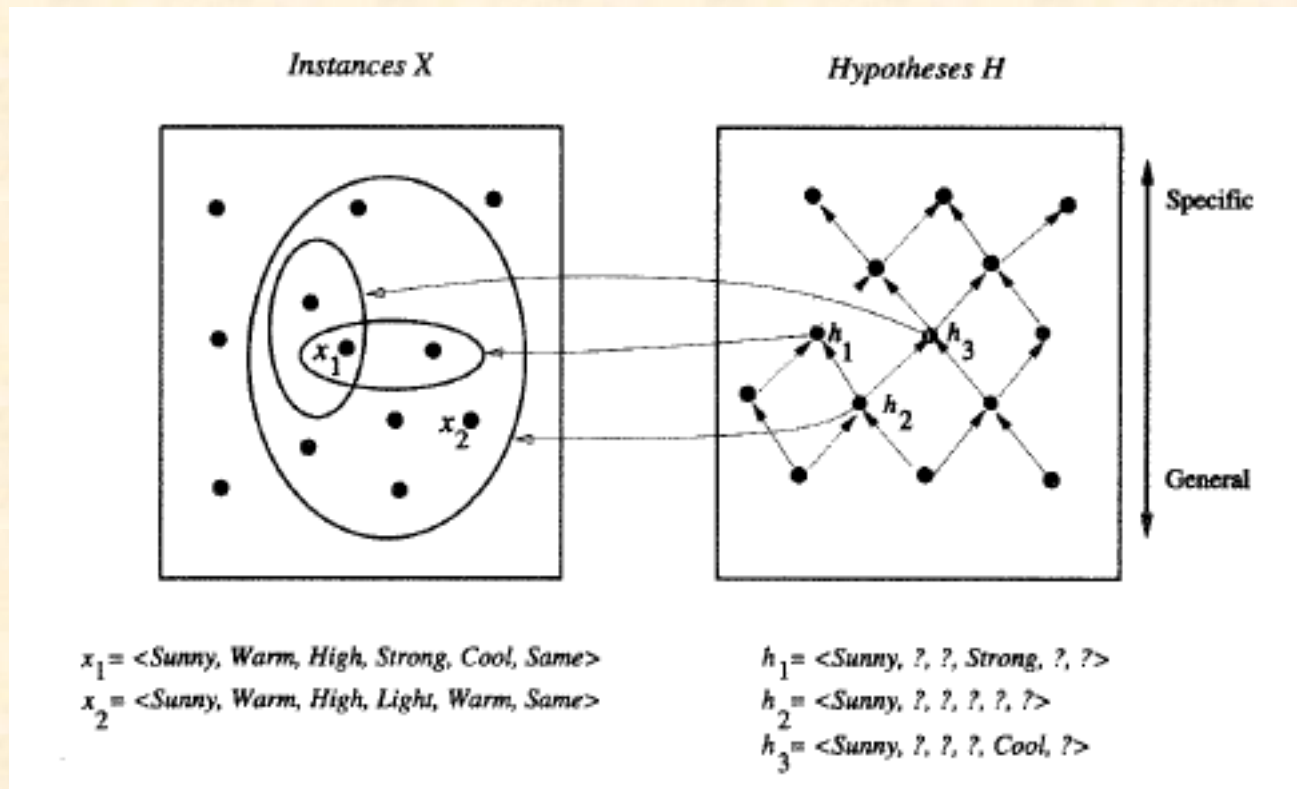
- **Determine:**

- A hypothesis h in H such that $h(x) = c(x)$ for all x in X .
-

Quante istanze possibili? E quante ipotesi?

Apprendimento di Concetti (2)

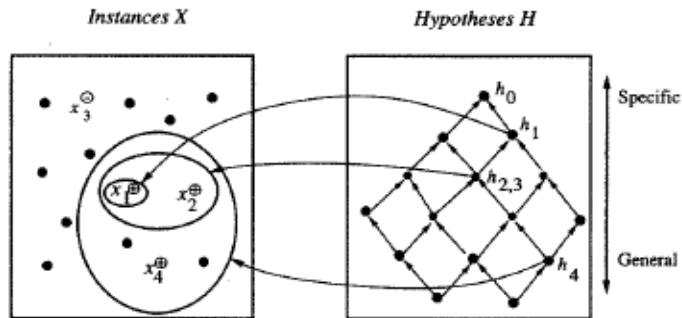
Struttura di H



Apprendimento di Concetti (3)

Find-S

1. Initialize h to the most specific hypothesis in H
2. For each positive training instance x
 - For each attribute constraint a_i in h
 - If the constraint a_i is satisfied by x
 - Then do nothing
 - Else replace a_i in h by the next more general constraint that is satisfied by x
3. Output hypothesis h



$x_1 = \langle \text{Sunny Warm Normal Strong Warm Same} \rangle, +$
 $x_2 = \langle \text{Sunny Warm High Strong Warm Same} \rangle, +$
 $x_3 = \langle \text{Rainy Cold High Strong Warm Change} \rangle, -$
 $x_4 = \langle \text{Sunny Warm High Strong Cool Change} \rangle, +$

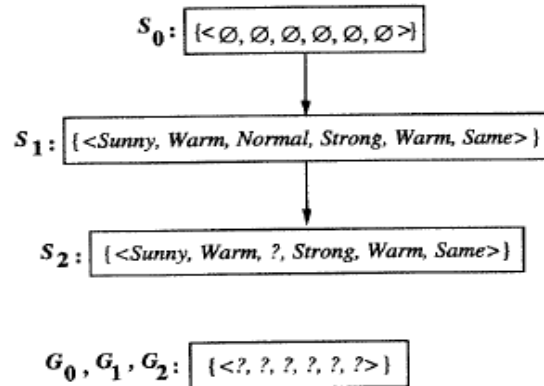
$h_0 = \langle \emptyset, \emptyset, \emptyset, \emptyset, \emptyset, \emptyset \rangle$
 $h_1 = \langle \text{Sunny Warm Normal Strong Warm Same} \rangle$
 $h_2 = \langle \text{Sunny Warm ? Strong Warm Same} \rangle$
 $h_3 = \langle \text{Sunny Warm ? Strong Warm Same} \rangle$
 $h_4 = \langle \text{Sunny Warm ? Strong ? ?} \rangle$

- 0) $h : \langle 0,0,0,0,0,0 \rangle$
- 1) $h : \langle S,W,N,S,W,S \rangle$
- 2) $h : \langle S,W,?,S,W,S \rangle$
- 3) Nothing
- 4) $h : \langle S,W,?,S,?,? \rangle$

Example	Sky	AirTemp	Humidity	Wind	Water	Forecast	EnjoySport
1	Sunny	Warm	Normal	Strong	Warm	Same	Yes
2	Sunny	Warm	High	Strong	Warm	Same	Yes
3	Rainy	Cold	High	Strong	Warm	Change	No
4	Sunny	Warm	High	Strong	Cool	Change	Yes

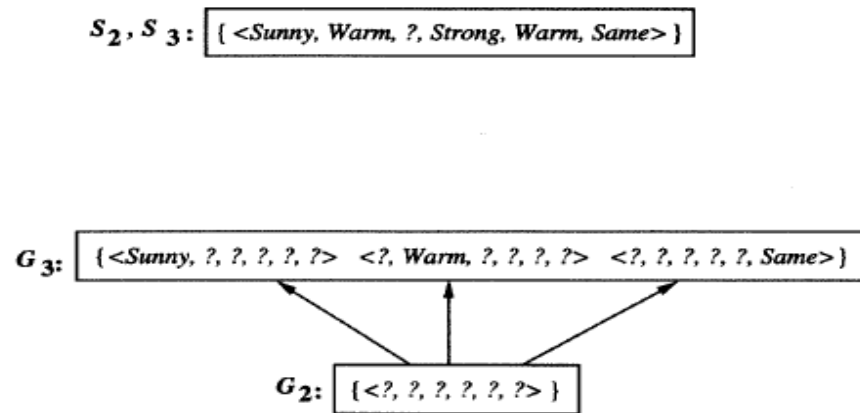
Apprendimento di Concetti (4)

Candidate-Elimination



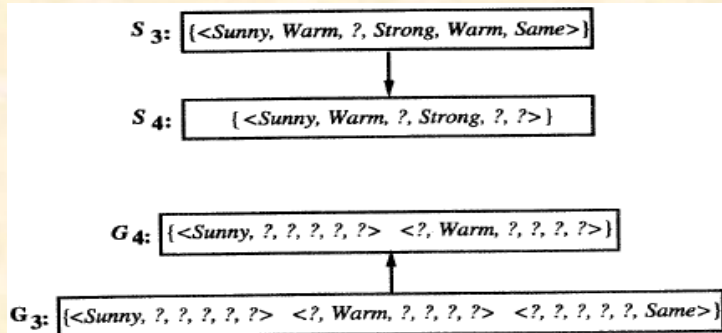
Training examples:

1. $\langle \text{Sunny, Warm, Normal, Strong, Warm, Same} \rangle, \text{Enjoy Sport} = \text{Yes}$
2. $\langle \text{Sunny, Warm, High, Strong, Warm, Same} \rangle, \text{Enjoy Sport} = \text{Yes}$



Training Example:

3. $\langle \text{Rainy, Cold, High, Strong, Warm, Change} \rangle, \text{EnjoySport} = \text{No}$



Training Example:

4. $\langle \text{Sunny, Warm, High, Strong, Cool, Change} \rangle, \text{EnjoySport} = \text{Yes}$

