MODULE - 1

1. Consider the Enjoy Sport concept and instance given below, identify the Specific hypothesis using Find-S algorithm.

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

* First initialize 'h' to the most specific hypothesis in H

$$h = \langle \phi, \phi, \phi, \phi, \phi, \phi \rangle$$

* Consider the first training instance.

$$x_1 = \langle \text{Sunny, warm, Normal, Strong, warm, Same} \rangle, +$$

Observing instance x_1, 'h' is too Specific so replace by the next more general constraint that fits the example.

$$h_1 = \langle \text{Sunny, warm, Normal, Strong, warm, Same} \rangle$$

* Consider Second training instance.

$$x_2 = \langle \text{Sunny, warm, High, Strong, warm, Same} \rangle, +$$

Observe 'x_2' with 'h_1' and replace by more general constraint

$$h_2 = \langle \text{Sunny, warm, ?, Strong, warm, Same} \rangle$$

* Consider third training instance.

$x_3 = \langle$ Rainy, Cold, High, Strong, warm, Change $\rangle$, —

Find-S algorithm ignores negative instances, so. $h_3 = h_2$

$h_3 = \langle$ Sunny, warm, ?, Strong, warm, Same $\rangle$

* Consider fourth training instance.

$x_4 = \langle$ Sunny, warm, High, Strong, ~~warm~~ Cool, change $\rangle$, +

Compare x_4 with h_3 and replace by more general constraint

$h_4 = \langle$ Sunny, warm, ?, Strong, ?, ? $\rangle$

The final Specific hypothesis for given instances is

$h_f = \langle$ Sunny, warm, ?, Strong, ?, ? $\rangle$

2. Consider the EnjoySport concept and instance given below, identify the general and specific hypotheses using Candidate - Elimination learning algorithm

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

* The boundary sets are first initialized to G_0 & S_0 the most general & most specific hypotheses in H

S_0 $\langle \phi, \phi, \phi, \phi, \phi, \phi \rangle$

G_0 $\langle ?, ?, ?, ?, ?, ? \rangle$

* Consider the first training instance.

$x_1 = \langle$ Sunny, Warm, Normal, Strong, Warm, Same $\rangle$

$S_0 = \langle \phi \ \phi \ \phi \ \phi \ \phi \ \phi \rangle$

$\downarrow$

$S_1 = \langle$ Sunny, Warm, Normal, Strong, Warm, Same $\rangle$

$G_0 \ G_1 = \langle ? \ ? \ ? \ ? \ ? \ ? \rangle$

* Consider second instance

$x_2 = \langle$ Sunny, warm, High, Strong, warm, Same $\rangle$ +

$S_1 = \langle$ Sunny, warm, Normal, Strong, warm, Same $\rangle$

↓

$S_2 = \langle$ Sunny, warm, ?, Strong, warm, Same $\rangle$

$G_1, G_2 = \langle ?, ?, ?, ?, ?, ? \rangle$

* Consider third instance which is negative.

$x_3 = \langle$ Rainy, Cold, High, Strong, warm, change $\rangle$ −

S_2 $S_3 = \langle$ Sunny, warm, ?, Strong, warm, Same $\rangle$

$G_3 = \langle$ Sunny, ? ? ? ? ? $\rangle$ $\langle$? warm ? ? ? ? $\rangle$
$\langle$? ? ? ? ? Same $\rangle$

↑

G_2 $\langle ?, ?, ?, ?, ?, ? \rangle$

* Consider the fourth instance.

x_4 = <Sunny, warm, High, Strong, cool, change>

S_3 = <Sunny, warm, ?, Strong, warm, Same>

↓

S_4 = <Sunny, warm, ?, Strong, ? ?>

G_4 = <Sunny ? ? ? ? ?> <? warm ? ? ? ?>

↑

G_3 = <Sunny, ? ? ? ? ?> <? warm ? ? ? ?>
<? ? ? ? ? warm>

S_4 and G_4 are the final set of hypotheses which are consistent to training instances

3. Consider the "Japanese Economy Car" concept and instance given below, identify the hypotheses using Candidate - Elimination learning algorithm.

Origin	Manufacturer	Color	Decade	Type	Target Value
Japan	Honda	Blue	1980	Economy	Positive
Japan	Toyota	Green	1970	Sports	Negative
Japan	Toyota	Blue	1990	Economy	Positive
USA	Chryler	Red	1980	Economy	Negative
Japan	Honda	White	1980	Economy	Positive

* Initialize G_0 & S_0.

S_0 ⟨Japan ∅ ∅ ∅ ∅ ∅⟩

G_0 ⟨? ? ? ? ?⟩

* Consider the first training instance

x_1 = ⟨Japan, Honda, Blue, 1980, Economy⟩ +

S_0 = ⟨∅ ∅ ∅ ∅ ∅⟩

S_1 = ⟨Japan, Honda, Blue, 1980, Economy⟩

G_0 G_1 = ⟨? ? ? ? ?⟩

* Consider Second ~~training~~ instance.

$x_2 = \langle$ Japan, Toyota, Green, 1970, Sports $\rangle$ —

Specialize G to exclude the negative example.

$S_1 = S_2 = \langle$ Japan, Honda, Blue, 1980, Economy $\rangle$

$G_2 = \langle ?$ Honda $? ? ? \rangle \langle ?? $ Blue $? ? \rangle$
$\langle ? ? ? $ 1980 $? \rangle \langle ? ? ? ? $ Economy $\rangle$

↑

$G_1 = \langle ? ? ? ? ? \rangle$

* Considers third traing instance.

$x_3 = \langle$ Japan, Toyota, Blue, 1990, Economy $\rangle$

Prune G to exclude inconsistent hypothesis with the posite example and generalize S to include with positive example.

$S_3 = \langle$ Japan ? Blue ? Economy $\rangle$

$G_3 = \langle ? ?$ Blue $? ? \rangle \langle ? ? ? ?$ Economy $\rangle$

* Consider fourth instance

$x_4 = \langle$ USA, Chrysler, Red, 1980, Economy$\rangle$ –

Specialize G to include the negative example but stay consistent with S.

$S_4 = \langle$ Japan ? Blue, ? Economy$\rangle$

$G_4 = \langle$? ? Blue ? ?$\rangle$ $\langle$ Japan ? ? ? Economy$\rangle$

* Consider fifth instance

$x_5 = \langle$ Japan, Honda, White, 1980, Economy$\rangle$

Prune G to exclude inconsistent hypotheses with positive example and generalize S.

$S_5 = \langle$ Japan, ? ? ? Economy$\rangle$

$G_5 = \langle$ Japan, ? ? ? Economy$\rangle$

These are the final set of hypotheses which consistent with the training instance.