

* Learning Problems

Computer Program is said to learn from experience E wrt T (class of tasks)
 P (performance measure)

if its performance at task T improves with E

3 features of well defined problem

- i) class of tasks (T)
- ii) performance measure (P)
- iii) experience (E)

Eg: Checkers

$T \rightarrow$ playing checkers

$P \rightarrow$ % of games won

$E \rightarrow$ playing interactive games v/s itself

* Designing a Learning System

i) Choosing the training experience

- direct or indirect feedback
- degree to which learner controls sequence of eg
- how well it represents distribution of eg

ii) Choosing the Target Function

- what type of knowledge is learned?
- Choose Next Move. (a) V st $V(b) = 100$
if $b(\text{board state})$ is W

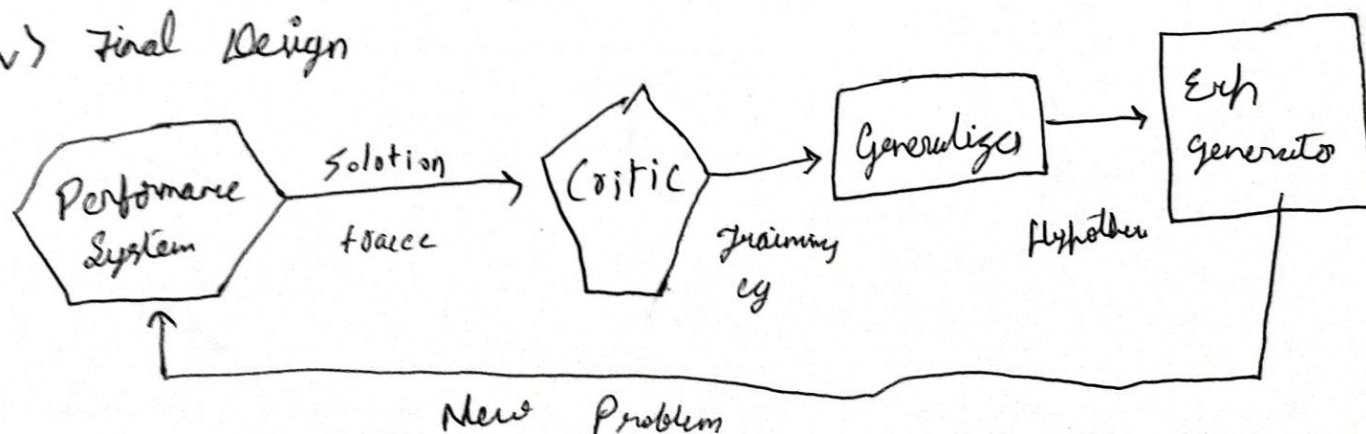
iii) Choosing representation for target function

- linear comb repr
- $V(b) = w_1 x_1 + w_2 x_2 + \dots + w_6 x_6$
 $w \rightarrow \text{weights}$ $x \rightarrow \text{num}$ attributes

iv) Choosing function approximation algorithm

- (- estimate training values, - adjust weights)

v) Final Design



Perspective

CONCEPTS

"After a while, we found that the
"idea of a 'good' or 'bad' person is not
"helpful in understanding human behavior."

"It is more useful to think of people as
"being influenced by their environment and
"their own choices."

Issues

What are the main issues in psychology?

1. Nature vs. Nurture

2. Free Will vs. Determinism

3. The Mind-Body Problem

4. The Role of Emotion in Decision Making

5. The Role of Social Factors in Behavior

6. The Role of Culture in Psychology

7. The Role of Genetics in Psychology

8. The Role of Development in Psychology

9. The Role of Learning in Psychology

10. The Role of Research in Psychology

11. The Role of Ethics in Psychology

12. The Role of Clinical Psychology

CONCEPT LEARNING

"Inferring a boolean valued function from training examples of input and output."

Automatically inferring general defⁿ of some concept (bird) given examples labelled as members or non-members

Concept Learning Task

Sky Temp Humidity Wind Enjoy Sport

"Learning set of days for which Enjoy Sport = YES"

Most general hypothesis: ? ? ? ? \rightarrow YES for everything

Most specific hypothesis: \emptyset \emptyset \emptyset \emptyset \rightarrow NO - -

X = Instances = Possible days

Attributes = S T H W

C = Target Concept = Enjoy Sport

H = Hypothesis = Conjunction of constraints on attributes
 $\hookrightarrow (\emptyset, ?, \text{Warm})$

DETERMINE h in H such that $h(x) = c(x)$

Concept Learning a Search

FIND - S

Finding maximally specific hypothesis

i) Initialize (h) to most specific hypothesis

ii) for each + instance x

for each attribute constraint (a) in h

if a is satisfied by x

do nothing

else

replace a in $[h]$ by next more general ~~hypothesis~~ constraint

iii) Output h

In table 2.1

$$1) h = \{\emptyset, \emptyset, \emptyset, \emptyset, \emptyset, \emptyset\}$$

$$2) \text{ After } x_1 = \{s, w, N, s, w, s\}$$

$$h = \{s, w, \underline{N}, s, w, s\}$$

$$3) \text{ After } x_2 = \{s, w, \underline{H}, s, w, s\}$$

$$h = \{s, w, ?, s, w, s\}$$

$$4) \text{ After } x_3 = \{ \dots \} \quad \boxed{\text{NO}}$$

Ignore

$$5) \text{ After } x_4 = \{s, w, H, s, C, C\}$$

$$h = \{s, w, ?, s, ?, ?\}$$

CANDIDATE ELIMINATION

Output set of all hypotheses consistent with training examples

* A hypothesis h is consistent with a set of training examples D iff $h(x) = c(x)$
~~for $\forall \langle x, c(x) \rangle$ in D~~

* Version Space ($VS_{H,D}$) is subset of hypotheses from H consistent with training examples

Algorithm

Initialize $G \rightarrow$ maximally general h

Initialize $S \rightarrow$ maximally specific h

$$S_0 = \{\emptyset, \emptyset, \emptyset, \emptyset, \emptyset, \emptyset\}$$

$$S_1 = \{S, W, N, S, W, S\}$$

$$S_2 = \{S, W, ?, S, W, S\} = S_3$$

$$S_4 = \{S, W, ?, S, ?, ?\}$$

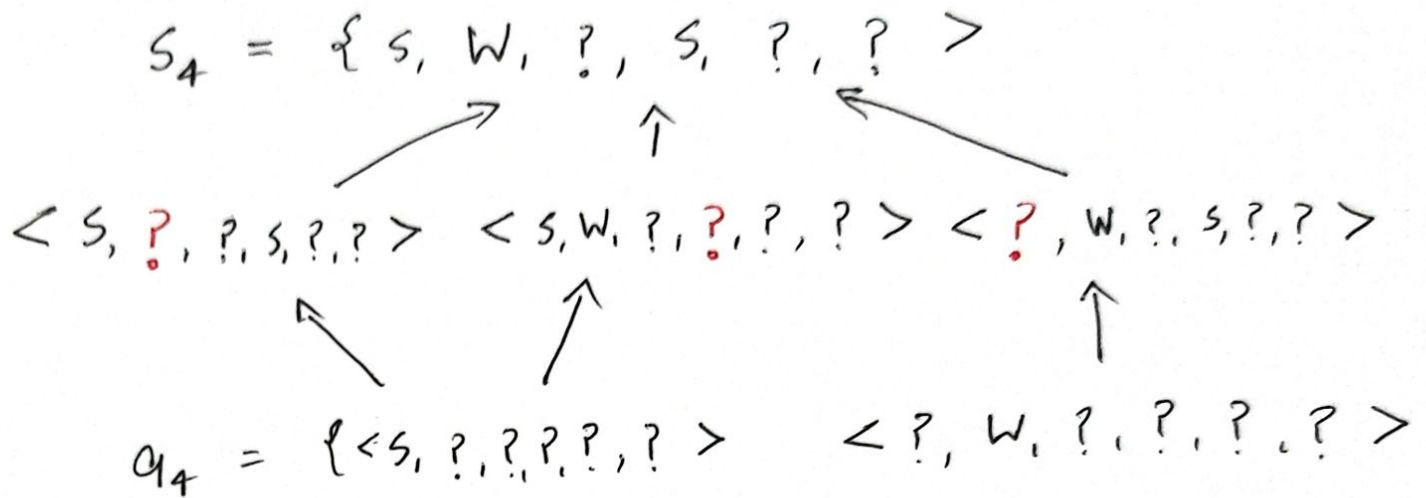
$$Q_4 = \langle S, ???? \rangle \langle ? W ??? \rangle$$

$$Q_3 = \langle S, ???? \rangle \langle ?, Warm, ??? \rangle \langle ??N?? \rangle \langle ???C.. \rangle \langle ???San \rangle$$

$$Q_0 = \{?, ?, ?, ?, ?, ?\} = Q_1 = Q_2$$

- 1) S_0 and Q_0
- 2) S_1 and S_2 because target fn is YES & matches $Q_0 = Q_1 = Q_2$
- 3) NO so $S_3 = S_2$
- 4) Opposite of example 3 is YES. Write combinations
 - Rainy \rightarrow Sunny
 - Cold \rightarrow Warm
 - High \rightarrow Normal
 - Strong \rightarrow nothing opposite
 - ...
- 5) $\langle \dots N \dots \rangle$ and $\langle \dots C \dots \rangle$ is not consistent with S_3
so remove them
- 6) S_4 and also in $Q_4 \langle \dots S \dots \rangle$ is inconsistent

Final Version Space (from S_4 and Q_4)



* Inductive Bias

