Notes on Version Space

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G-Set: A set of most general hypotheses

S-Set: A set of most specific hypotheses

To Generalize: Change $P \wedge Q \wedge R$ to $P \wedge Q$

To Specialize: Change $P \vee Q \vee R$ to $P \vee Q$
Change P to $P \wedge Q$

Algorithm

Let X be an example
C(X) be the category of X, either + or -

Initialization: G-Set $\leftarrow$ {True}
S-Set $\leftarrow$ {False}
or singleton of 1^{st} + instance

For each $S_i \in$ S-Set
- if S_i(X) = + and C(X) = - {false positive}
  - remove S_i from S-Set
- if S_i(X) = - and C(X) = + {false negative}
  - replace S_i by all immediate generalizations such that each one implies at least one G_i and accepts X.

For each $G_i \in$ G-Set
- if G_i(X) = - and C(X) = + {false negative}
  - remove G_i from G-Set
- if G_i(X) = + and C(X) = - {false positive}
  - replace G_i by all immediate specializations using predicates from S-Set, such that each one rejects X.

Examples

Features: Size: small, large
Color: white, black
Shape: circle, triangle, square

Learn: small circle

G-Set = {True}
S-Set = {False}

X = small white circle, C(X) = +
G_1(X) = + correct
G-Set = {True}
S_1(X) = - incorrect
replace by small $\wedge$ white $\wedge$ circle
S-Set = {small $\wedge$ white $\wedge$ circle}

G-Set = {True}
S-Set = {small $\wedge$ white $\wedge$ circle}

X = large white square, C(X) = -
G_1(X) = + incorrect
replace by {small, circle}
G-Set = {small, circle}
S_1(X) = - correct
S-Set = {small $\wedge$ white $\wedge$ circle}

X = small black circle, C(X) = +
G_1(X) = + correct
G_2(X) = + correct
G-Set = {small, circle}
S_1(X) = - incorrect
replace by {small $\wedge$ circle}
S-Set = {small $\wedge$ circle}

G-Set = {small, circle}

S-Set = {small $\wedge$ circle}

X = small black square, C(X) = -

G_1(X) = + incorrect

replace by {small $\wedge$ circle}

G_2(X) = - correct

but delete

because it's more general than the new G_1

G-Set = {small $\wedge$ circle}

S_1(X) = - correct

S-Set = {small $\wedge$ circle}