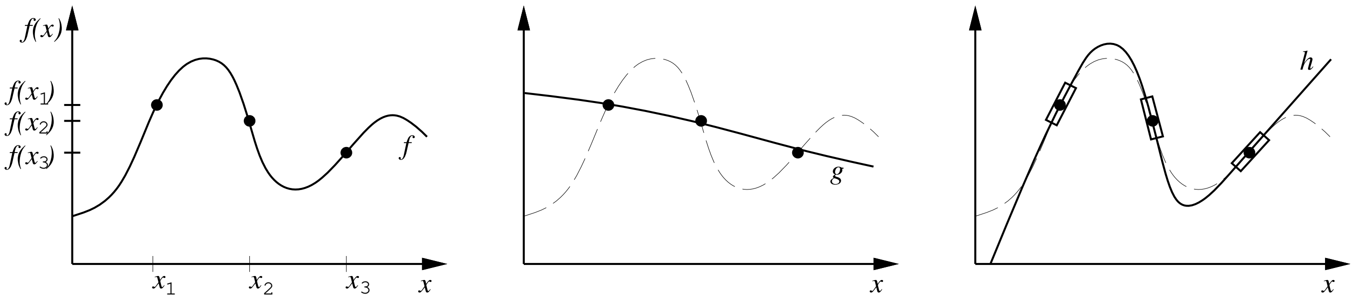
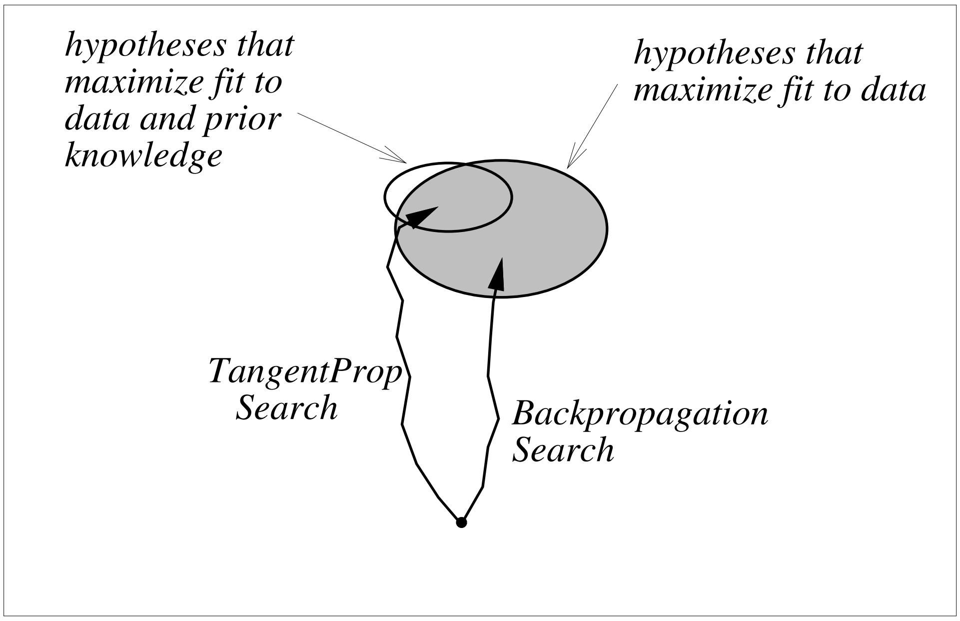
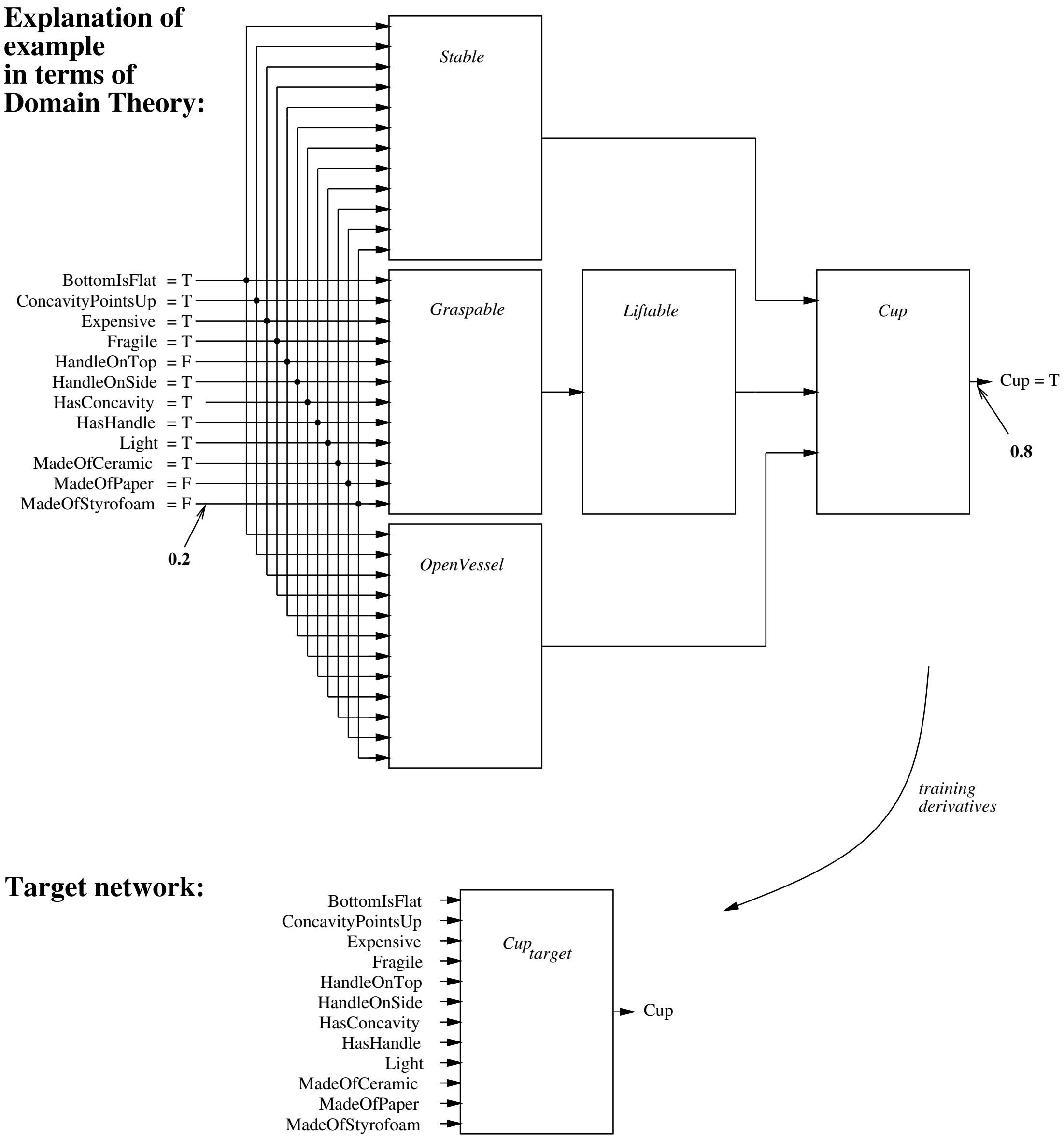


f(x)
f(x1)
f(x2)
f(x3)
f
x1
x2
x3
x
g
x
h
x

Hypothesis Space





Explanation of example in terms of Domain Theory:
Stable
Graspable
Liftable
Cup
OpenVessel
BottomIsFlat = T
ConcavityPointsUp = T
Expensive = T
Fragile = T
HandleOnTop = F
HandleOnSide = T
HasConcavity = T
HasHandle = T
Light = T
MadeOfCeramic = T
MadeOfPaper = F
MadeOfStyrofoam = F
0.2
Cup = T
0.8
training derivatives
Target network:
BottomIsFlat
ConcavityPointsUp
Expensive
Fragile
HandleOnTop
HandleOnSide
HasConcavity
HasHandle
Light
MadeOfCeramic
MadeOfPaper
MadeOfStyrofoam
Cup_target
Cup

Modified Objective for Gradient Descent

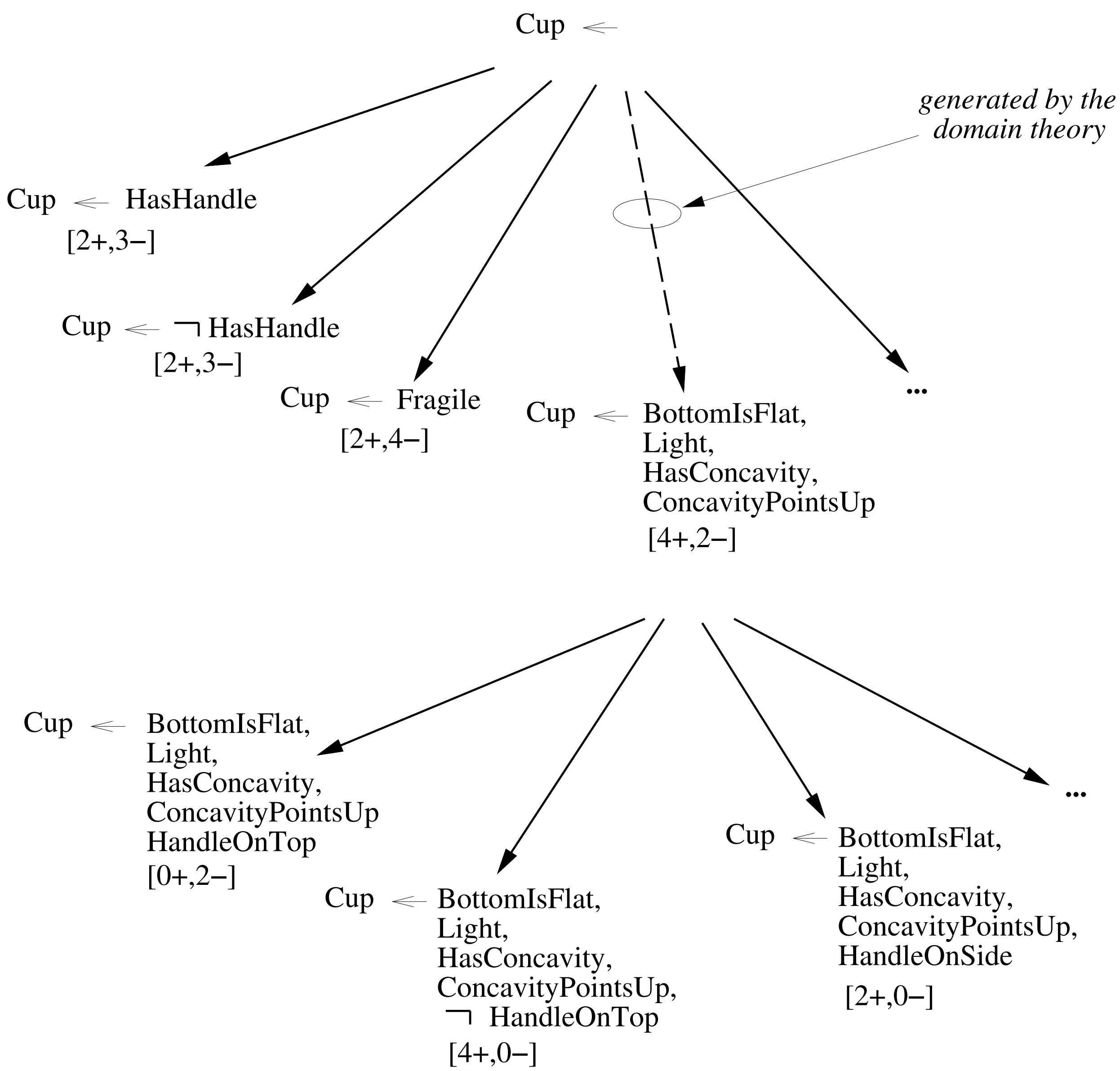
$$E = \sum_i \left[(f(x_i) - \hat{f}(x_i))^2 + \mu_i \sum_j \left(\frac{\partial A(x)}{\partial x^j} - \frac{\partial \hat{f}(x)}{\partial x^j} \right)^2_{(x=x_i)} \right]$$

where

$$\mu_i \equiv 1 - \frac{|A(x_i) - f(x_i)|}{c}$$

- $f(x)$ is target function
- $\hat{f}(x)$ is neural net approximation to $f(x)$
- $A(x)$ is domain theory approximation to $f(x)$

Search in FOCL



FOCL Results

Recognizing legal chess endgame positions:

- 30 positive, 30 negative examples
- FOIL: 86%
- FOCL: 94% (using domain theory with 76% accuracy)

NYNEX telephone network diagnosis

- 500 training examples
- FOIL: 90%
- FOCL: 98% (using domain theory with 95% accuracy)