Kinship Face Matching Game

`http://kinpic.n3.net`

One round consists of:

- One stimulus face
- Four response choices (one related face, three decoys)
- Player guesses which face is related

Goals

- Produce examples that challenge human players in each round
- Learn which examples are hard over time
- Make an interesting game for humans
- Generate facial similarity data (useful in other domains)

Goals achieved by learning hard decoys for each stimulus pair

Which is related? Click an image to submit your guess:




The target image:

Play Round

Add an Image Pair

Hidden Feature Vectors

- Each face image contains hidden vector of binary features
- Hamming distance $D(\bar{x}, \bar{y})$ = number of bits that differ
- Perceived distance between images $\bar{x}$ and $\bar{y}$: $2^{D(\bar{x},\bar{y})}$
- Ideal probability for for decoy $\bar{y}$ given target $\bar{x}$: $\frac{2^{-D(\bar{x},\bar{y})}}{Z}$
- Hidden feature vectors impossible to learn
- We *can* learn Hamming distances

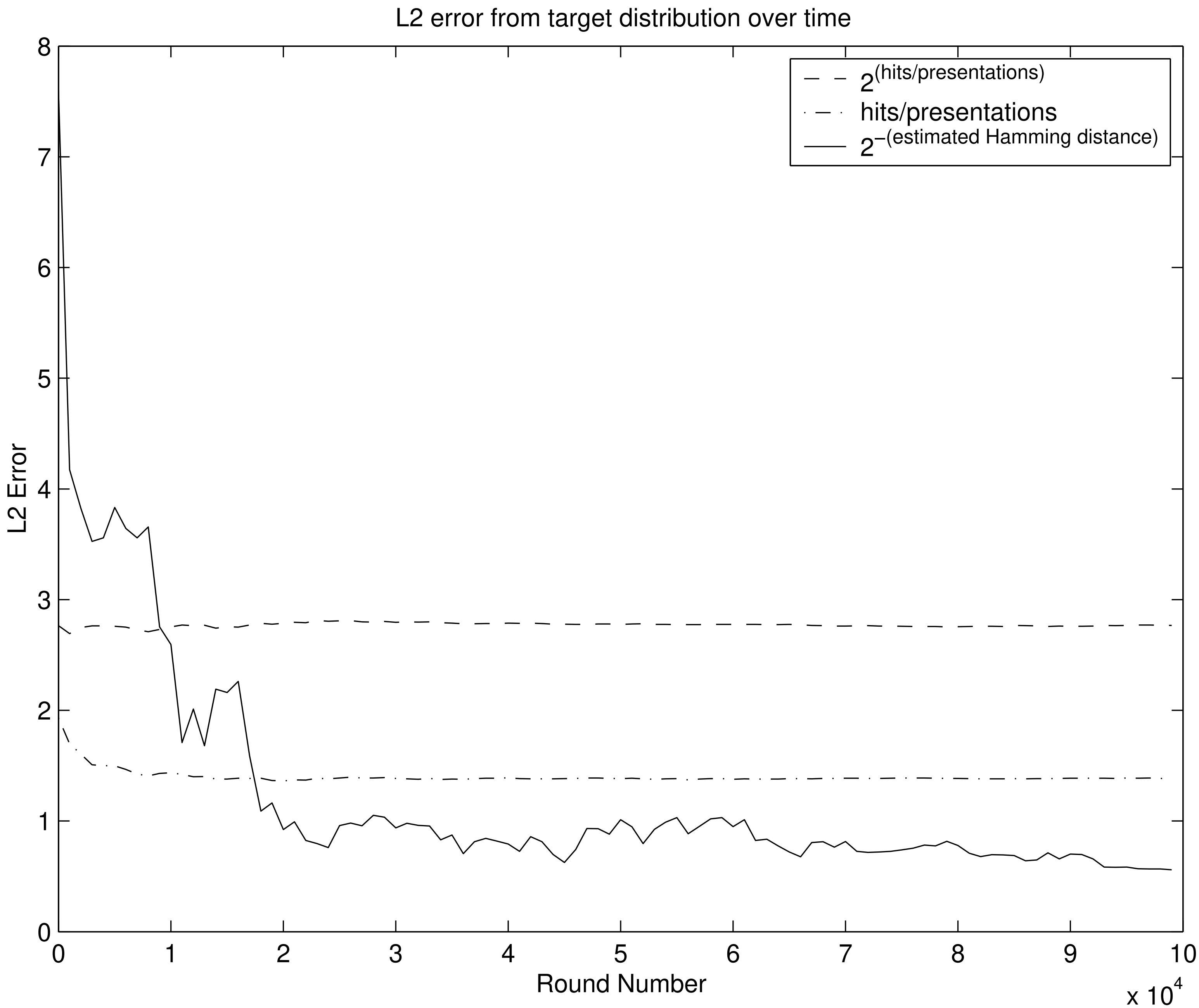
Learning the Hamming Distance

- $p_{y,m}$ = number of times example m was presented as decoy for example y, $h_{y,m}$ = number of times example m was "hit" (chosen) by players when presented as a decoy for example m

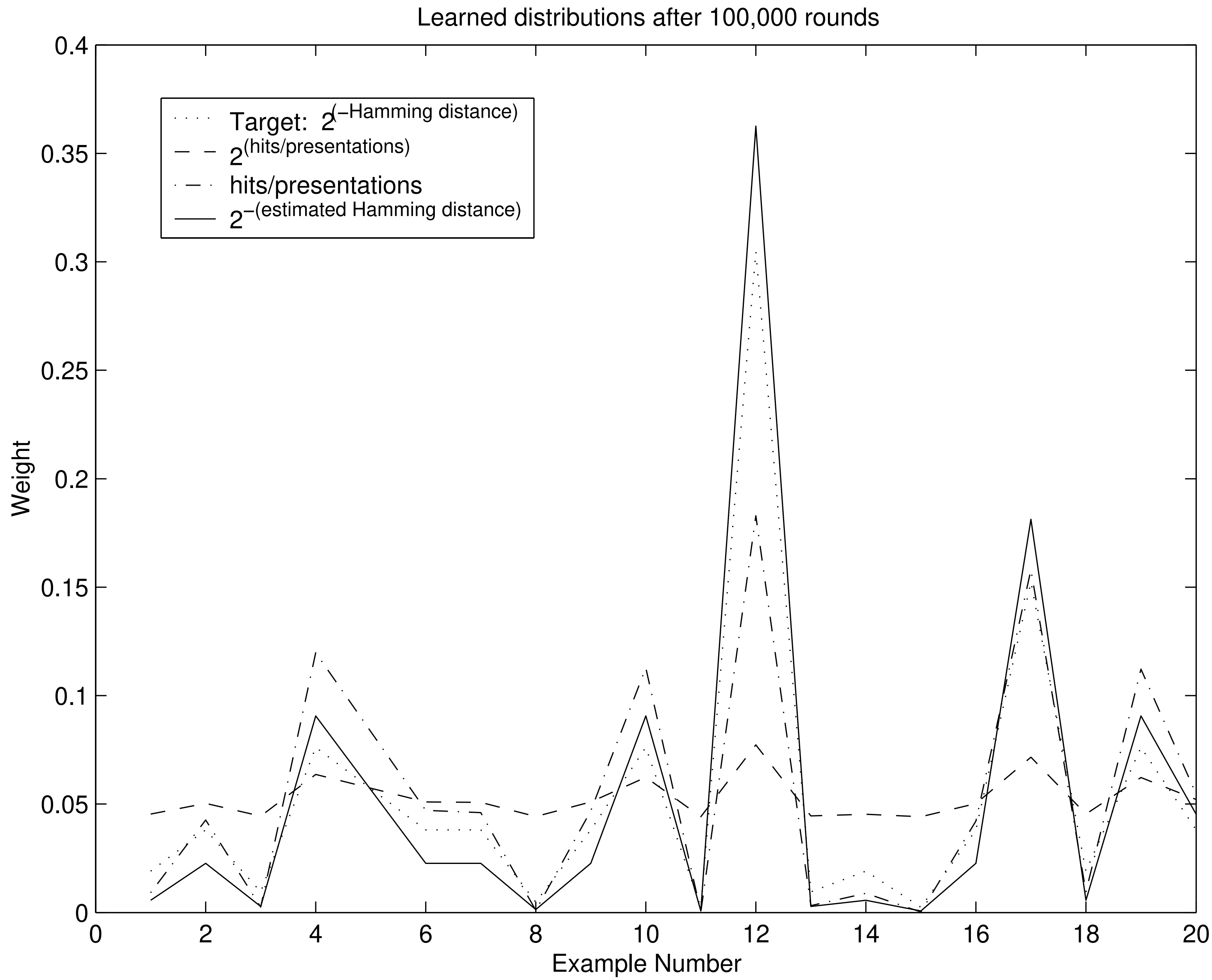
- $\frac{h_{y,m}}{p_{y,m}} = P$[2 decoys chosen at random have a larger Hamming distance from y than m]

- Uniformly distributed vectors $\Rightarrow D(y,z)$ (y,z randomly chosen) is a binomial RV X with PMF $P_X(x)$, so

$$\frac{h_{y,m}}{p_{y,m}} = \left(1 - \sum_{0}^{D(y,m)} P_X(x)\right)^2 \quad \text{(solve numerically for } D(y,m)\text{)}$$



L2 error from target distribution over time
L2 Error
Round Number
x 10^4
0
1
2
3
4
5
6
7
8
9
10
2^(hits/presentations)
hits/presentations
2^−(estimated Hamming distance)



Learned distributions after 100,000 rounds
Target: 2^(−Hamming distance)
2^(hits/presentations)
hits/presentations
2^−(estimated Hamming distance)
Weight
Example Number
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0
2
4
6
8
10
12
14
16
18
20