Kinpix: An Adversarial Algorithm for Generating Hard Queries

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Overview
**Game:** the user is given a picture of a *child* and a set of pictures of *parents*

**Goal:** choose the *true* parent among all

**Adversary:** make the queries as hard as possible, based on the past
Who is the "true" parent?

Submit

Next

correct = 6
incorrect = 1
Kernel Metric Learning

Start with an initial representation of the items, i.e., features. In every iteration:

- **correct**: move the decoys relatively away from the child than the true parent
- **incorrect**: move the wrong decoy relatively closer to the child than the true parent

This works when the children and parents can both be mapped to the same space.
For infants, we need different strategy!
Update: Incorrect Case
Problem formulation:

$$\min_K \Delta_{ld}(K, K_0)$$

subject to

$$\text{trace}(K C_{(i,j|k)}) \leq 0, \quad \text{for all } \{(i, j|k)\} \in I_{Rel}$$

$$K \succeq 0$$

Log det divergence:

$$\Delta_{ld}(K, K_0) = \text{trace}(K K_0^{-1}) - \log \det(K K_0^{-1}) - n,$$
Sampling Process

- Normalize columns of $K$ to get a transition probability matrix $P$
- Do a random walk on the Markov chain (explore-exploit strategy)

$$p_i = (1 - \lambda) P e_i + \lambda u$$

- Take true parent + sample decoys without replacement
- A decaying memory model for sampling new queries

$$w_i = \begin{cases} 
1 - \exp(-(t - t_i)/n_i), & \text{if previously chosen} \\
1, & \text{otherwise}
\end{cases}$$

sample from $\frac{w}{\|w\|_1}$
Experiments

Dataset: UB KinFace Database [?], contains images of 200 kins and their corresponding parents

Features: eigenfaces + intensity histograms (can’t do color histograms!), unsupervised deep features coming soon!

Need to do a user study to analyze learning curves, volunteers very much appreciated!

UB KinFace Database, available online at [http://www1.ece.neu.edu/~yunfu/research/Kinface/Kinface.htm](http://www1.ece.neu.edu/~yunfu/research/Kinface/Kinface.htm)