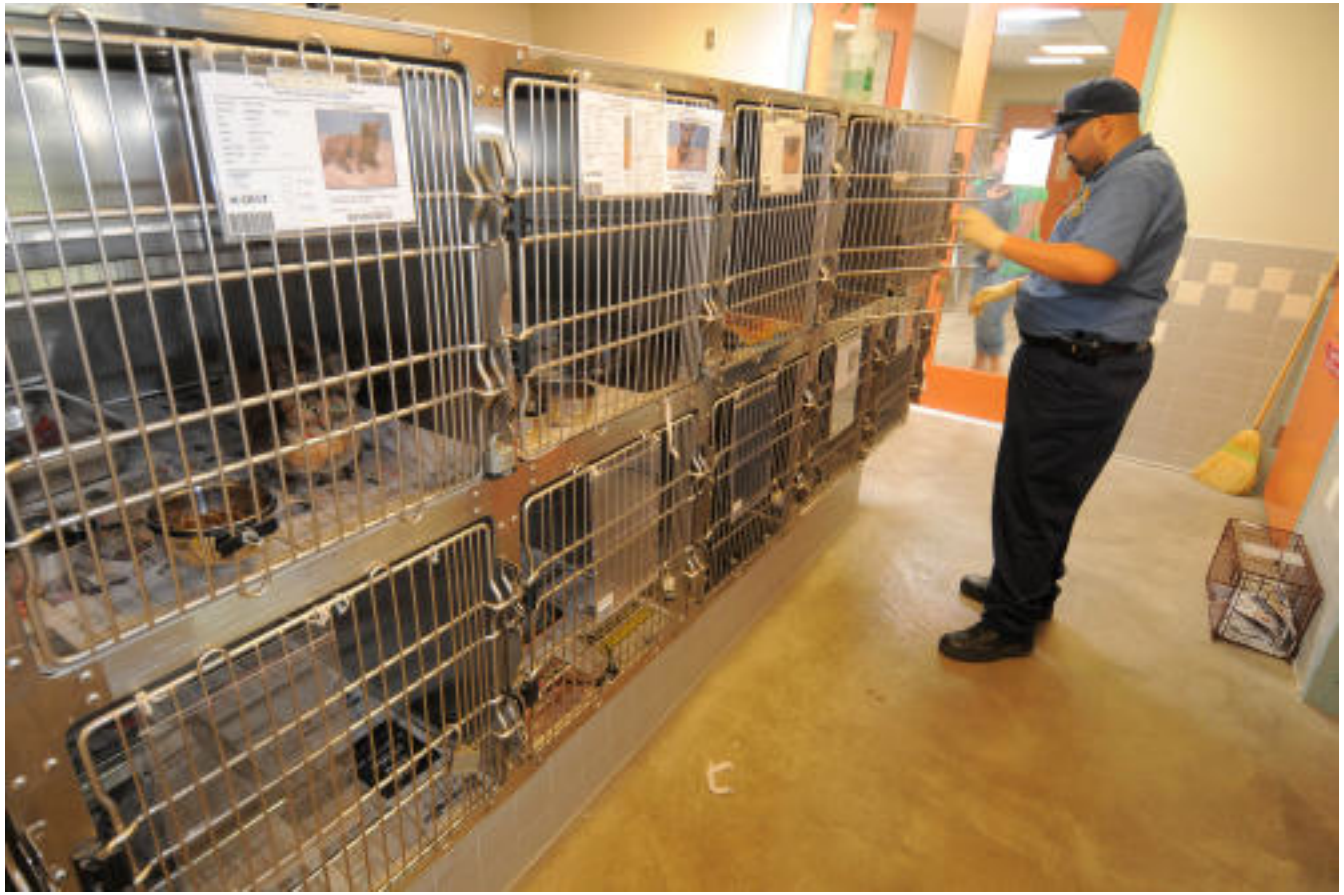
kittyTwin

Find a feline friend that looks just like you!

Katie Amrine

INSIGHT

"Of the cats entering shelters, approximately 37% are adopted, 41% are euthanized, and less than 5% of cats who came in as strays are returned to their owners." **-ASPCA**



Cats with more Petfinder.com activity get adopted **~ 3x** faster than cats with less activity

Petfinder

Home of 307,951 adoptable pets from 12,103 adoption groups.

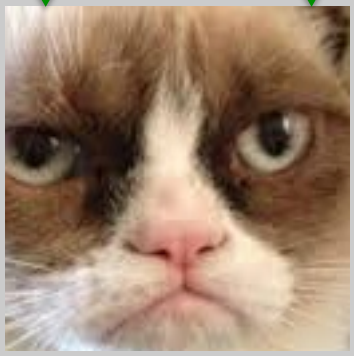
Cats with more Petfinder.com activity get adopted **~ 3x** faster than cats with less activity

Want to match this picture:

Eigenspace

Want to match this picture:

Test



Eigenspace

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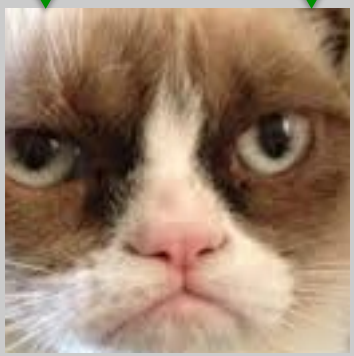

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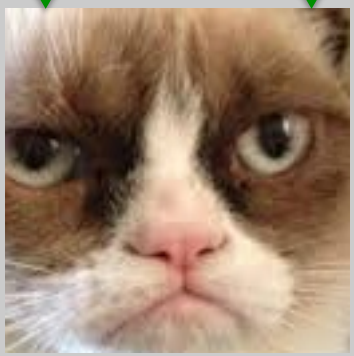

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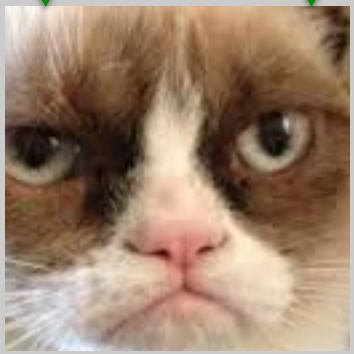
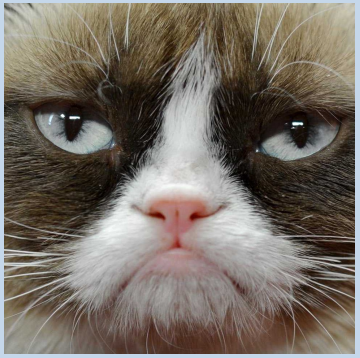


Eigenspace

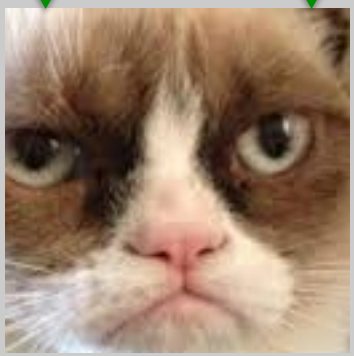
Train 1



Train 2

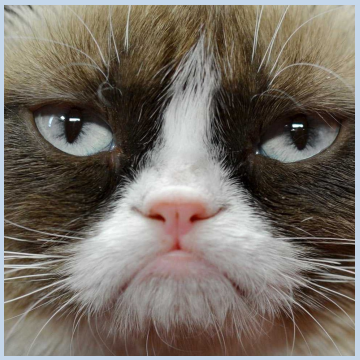
Want to match this picture:

Test



Eigenspace

Train 1

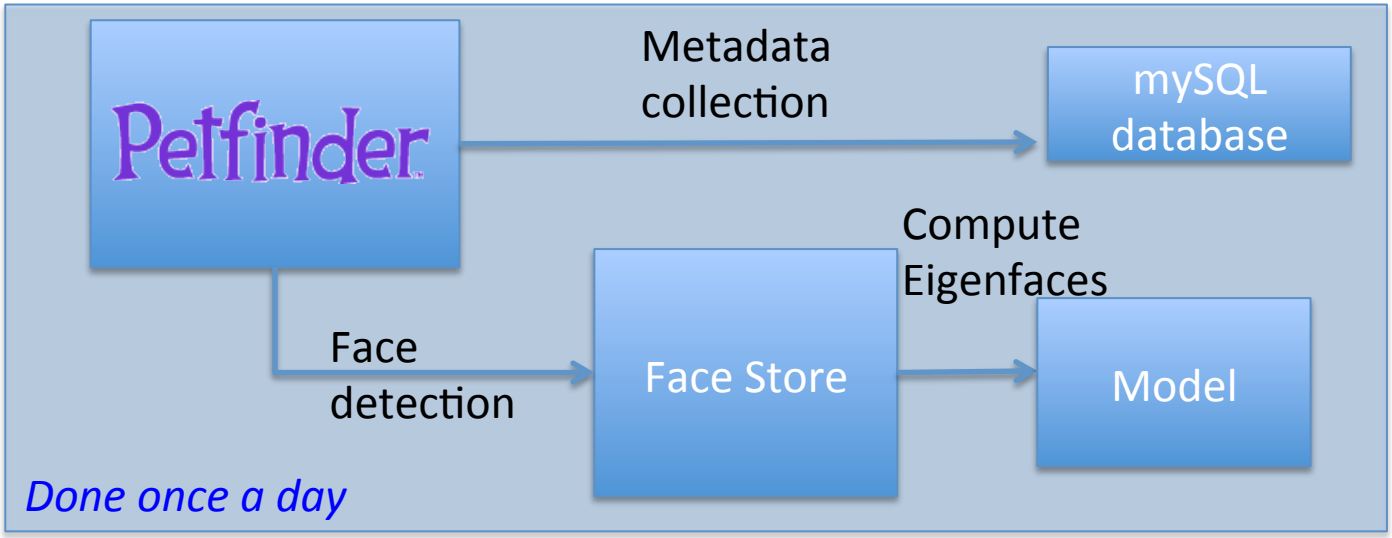


Train 2

Grumpycat !!!!

Algorithm (Eigenfaces Method)

Pull out most distinguishing features from each image and projects onto PCA subspace along with test image



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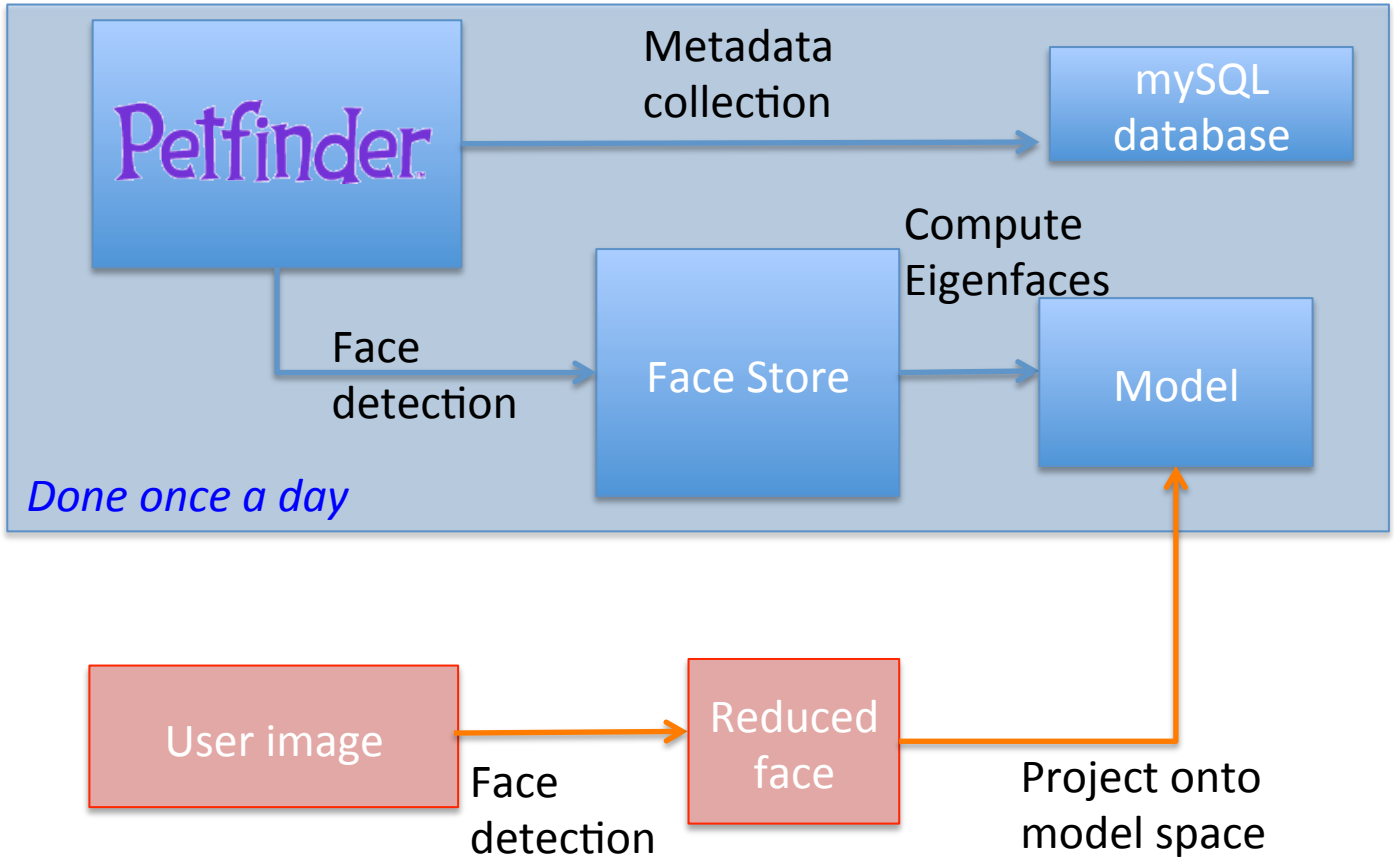

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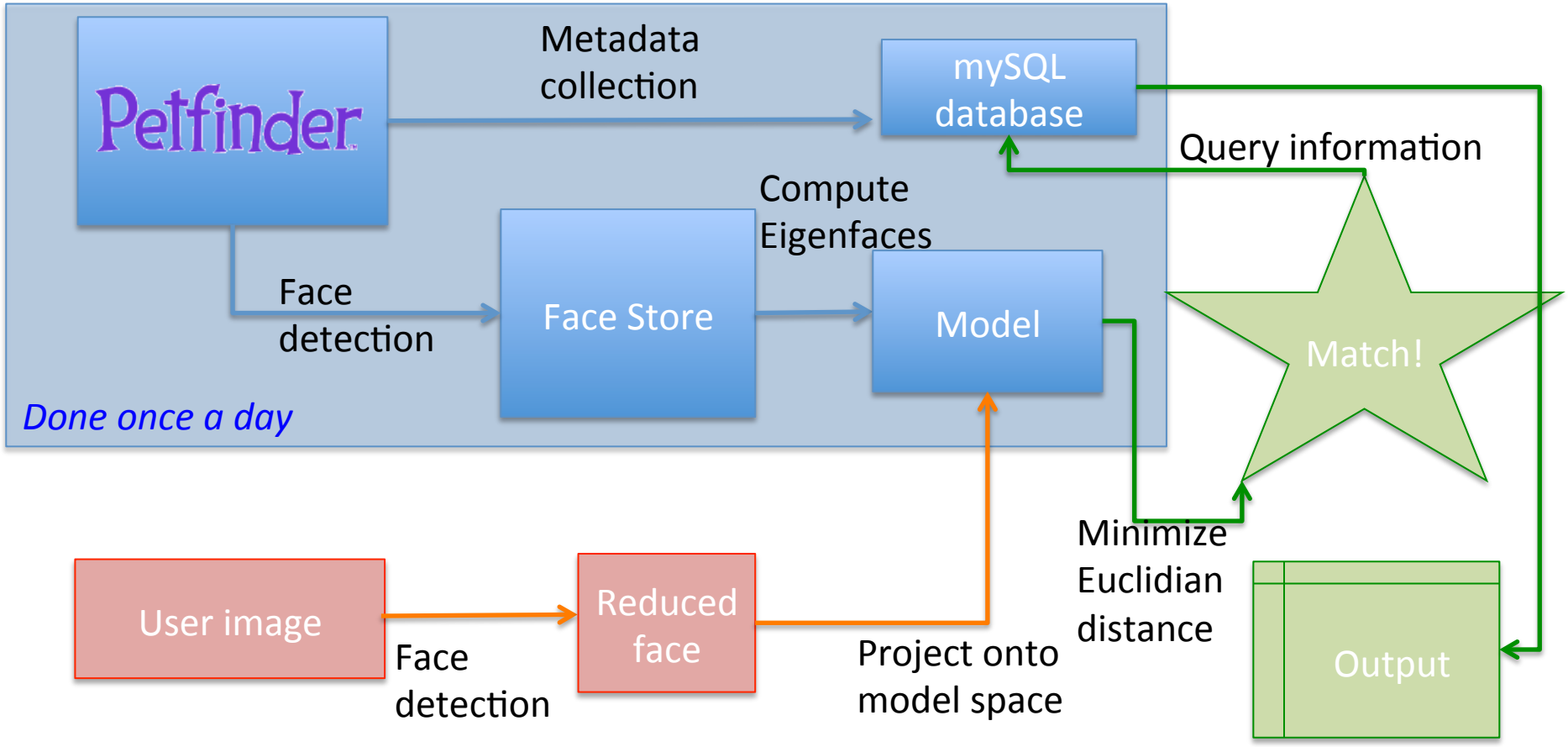
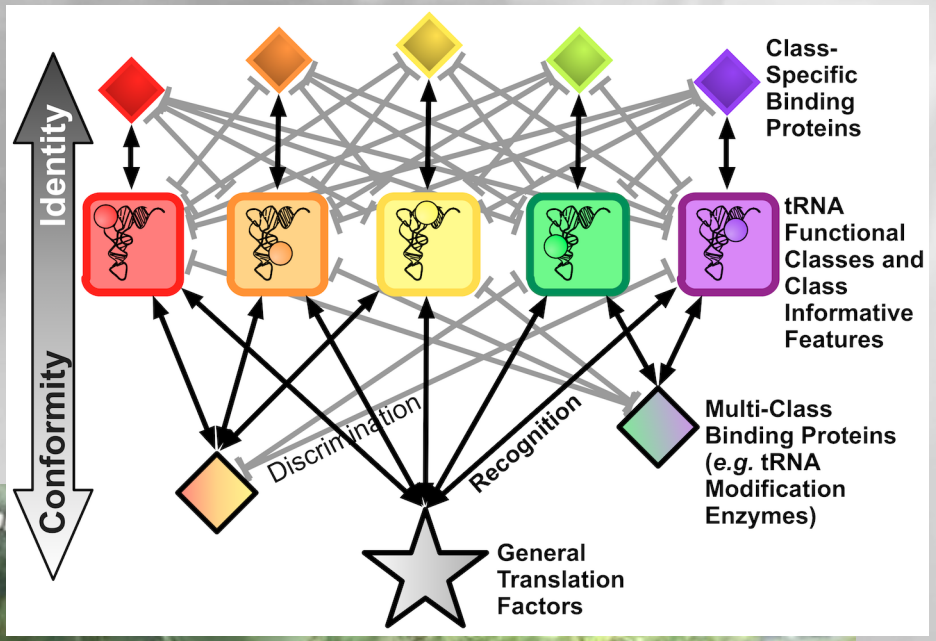


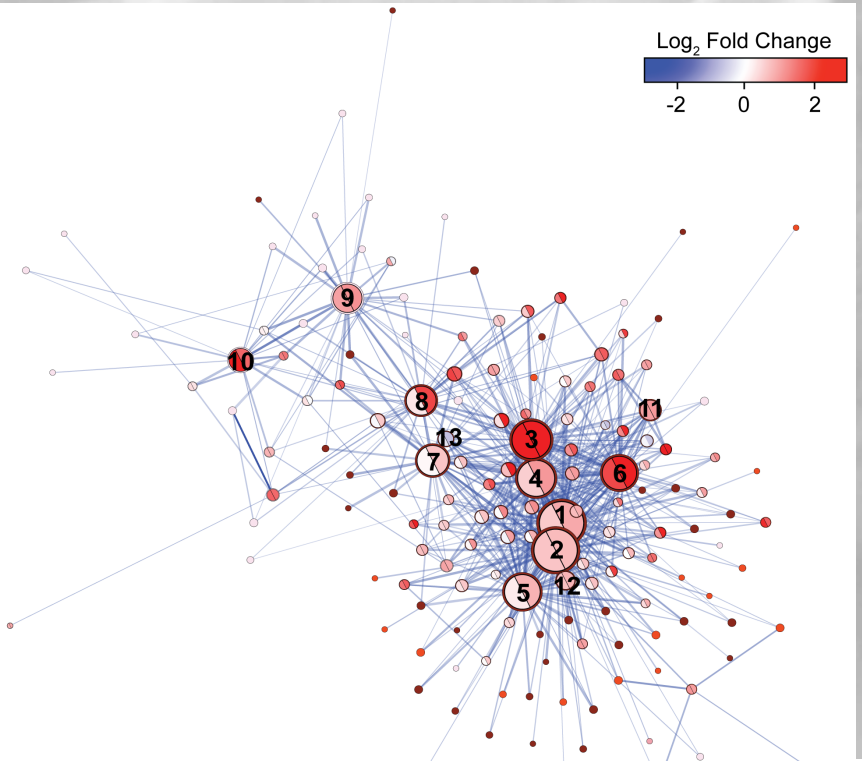
ADOPT ME!!!!!!

Katie Amrine

PhD – Quantitative & Systems Biology, UC Merced

Postdoc – Department of Viticulture & Enology, UC Davis



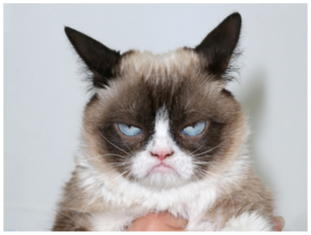


kittyTwin.me | Amrine_Insight_demo.pdf

www.kittytwin.me

kittyTwin

Find my kittyTwin!



Upload a frontal face image to start!

Choose File No file chosen

Find me my kittyTwin!

kittyTwin works on one human face at a time. If an image is submitted with more than one face, the clearer/larger face will be processed. kittyTwin will only match cats listed for adoption on Petfinder.com and is updated once a day with new listings. kittyTwin is an independent, entertainment-based site unaffiliated with Petfinder.com. Support your local animal shelter!

kittyTwin.me | Amrine_Insight_demo.pdf

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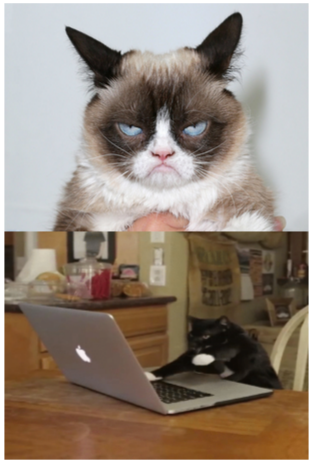


Finding your kittyTwin now. This may take a moment...

Upload a frontal face image to start!

Choose File john.jpg

Find me my kittyTwin!

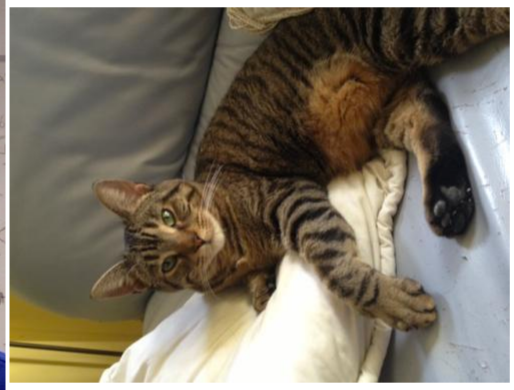
kittyTwin works on one human face at a time. If an image is submitted with more than one face, the clearer/larger face will be processed. kittyTwin will only match cats listed for adoption on Petfinder.com and is updated once a day with new listings. kittyTwin is an independent, entertainment-based site unaffiliated with Petfinder.com. Support your local animal shelter!

kittyTwin.me | Amrine_Insight_demo.pdf

www.kittytwin.me/output/IBD4JVJ1PY81.jpg

kittyTwin

We found a match!



Your kittyTwin is...

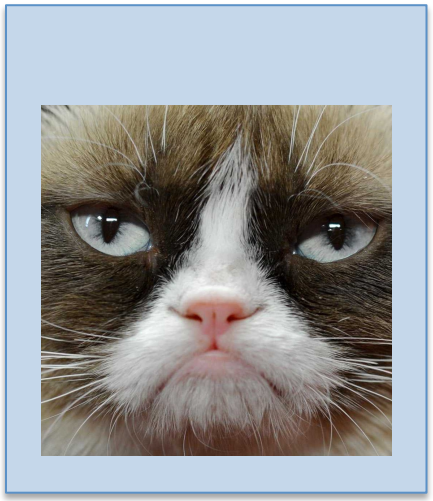
LouLou!!

LouLou is at your local shelter in Los Angeles

click here for more information

click here to search with another face

Angle matters most…



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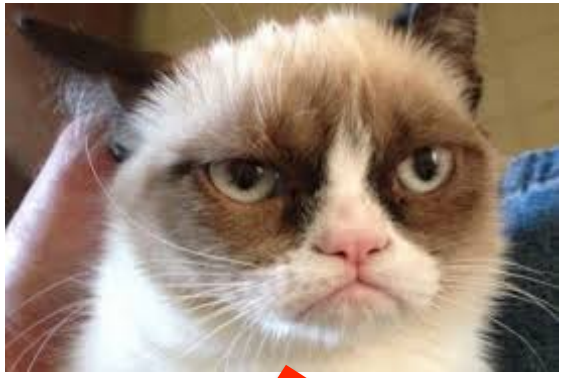
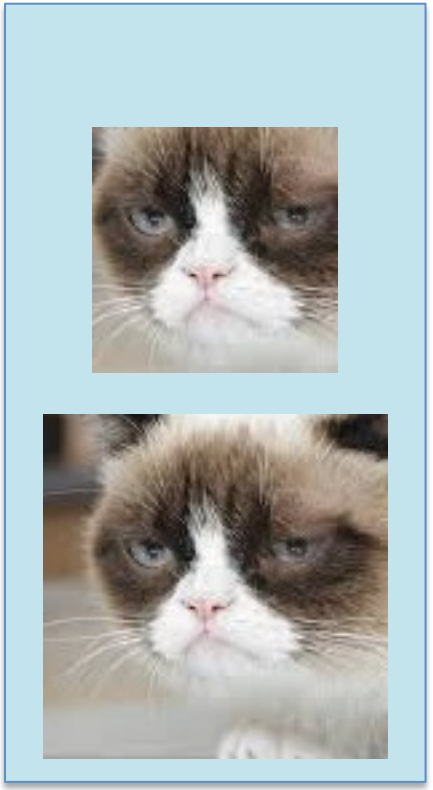


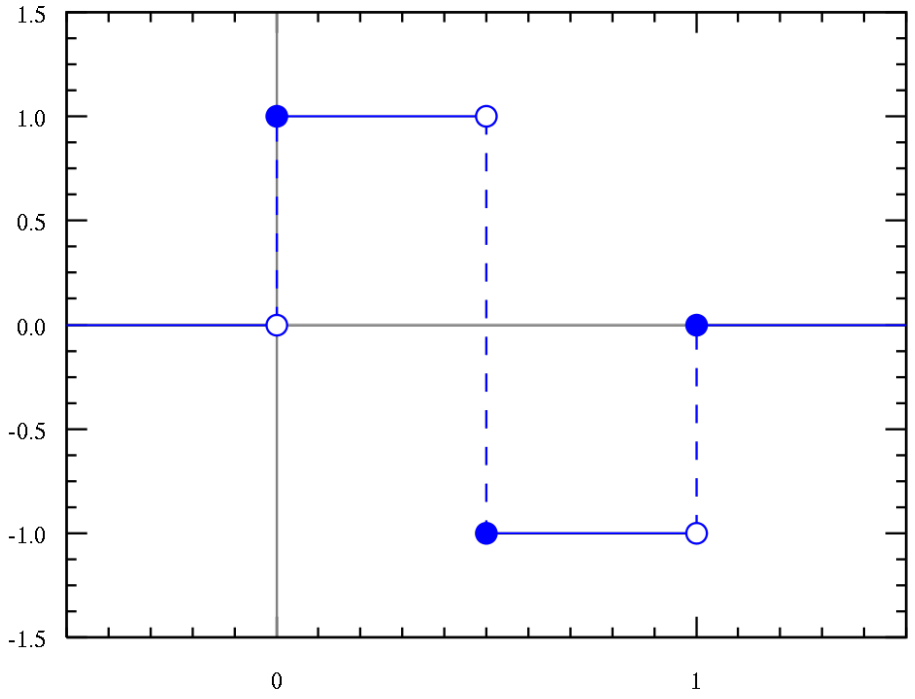


More detail…

Machine Learning: Feature Detection

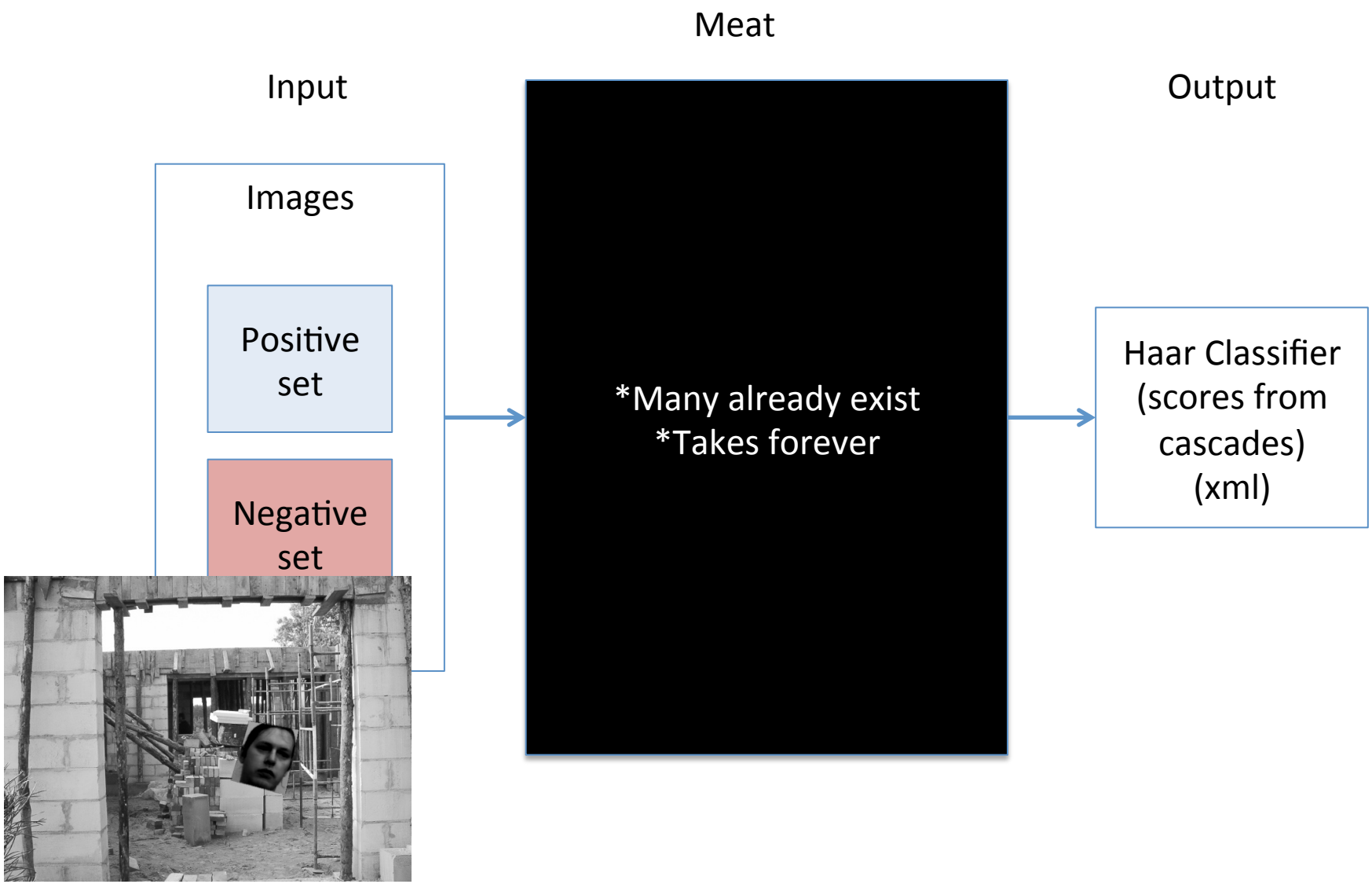
Haar Cascades

Wikipedia.org

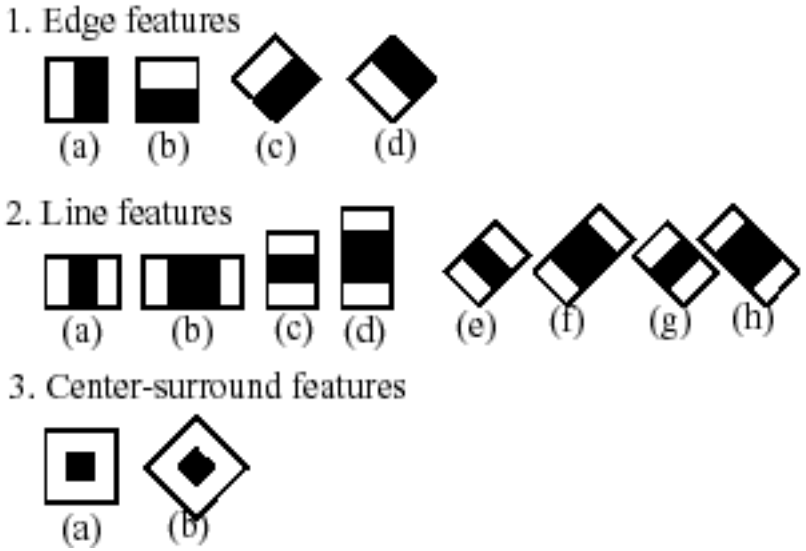


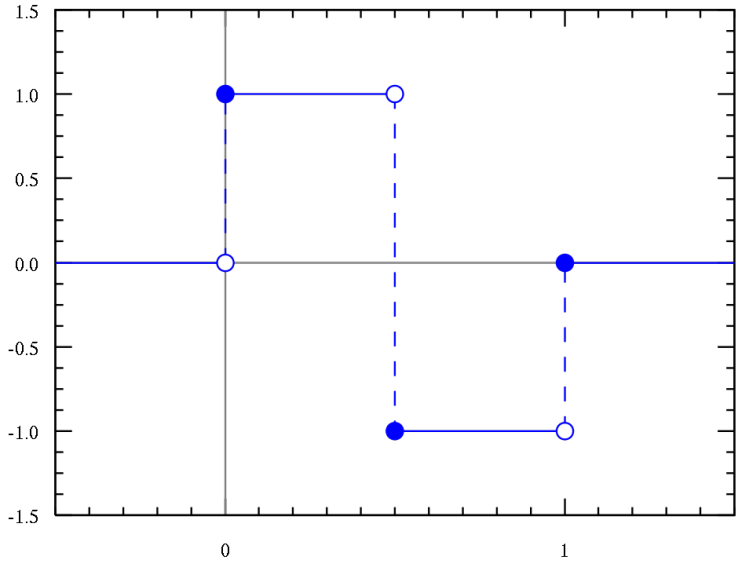
Haar wavelet

Training


Meat
Input
Output
Images
Positive set
Negative set
*Many already exist
*Takes forever
Haar Classifier (scores from cascades) (xml)

Detecting Haar-like Features





Input

Images

Positive set

Negative set

- Given example images $(x_1, y_1), \ldots, (x_n, y_n)$ where $y_i = 0, 1$ for negative and positive examples respectively.
- Initialize weights $w_{1,i} = \frac{1}{2m}, \frac{1}{2l}$ for $y_i = 0, 1$ respectively, where m and l are the number of negatives and positives respectively.
- For $t = 1, \ldots, T$:

  1. Normalize the weights,

  $$w_{t,i} \leftarrow \frac{w_{t,i}}{\sum_{j=1}^{n} w_{t,j}}$$

  so that w_t is a probability distribution.

  2. For each feature, j, train a classifier h_j which is restricted to using a single feature. The error is evaluated with respect to w_t, $\epsilon_j = \sum_i w_i |h_j(x_i) - y_i|$.
  3. Choose the classifier, h_t, with the lowest error ϵ_t.
  4. Update the weights:

  $$w_{t+1,i} = w_{t,i}\beta_t^{1-e_i}$$

  where $e_i = 0$ if example x_i is classified correctly, $e_i = 1$ otherwise, and $\beta_t = \frac{\epsilon_t}{1-\epsilon_t}$.

- The final strong classifier is:

$$h(x) = \begin{cases} 1 & \sum_{t=1}^{T} \alpha_t h_t(x) \geq \frac{1}{2} \sum_{t=1}^{T} \alpha_t \\ 0 & \text{otherwise} \end{cases}$$

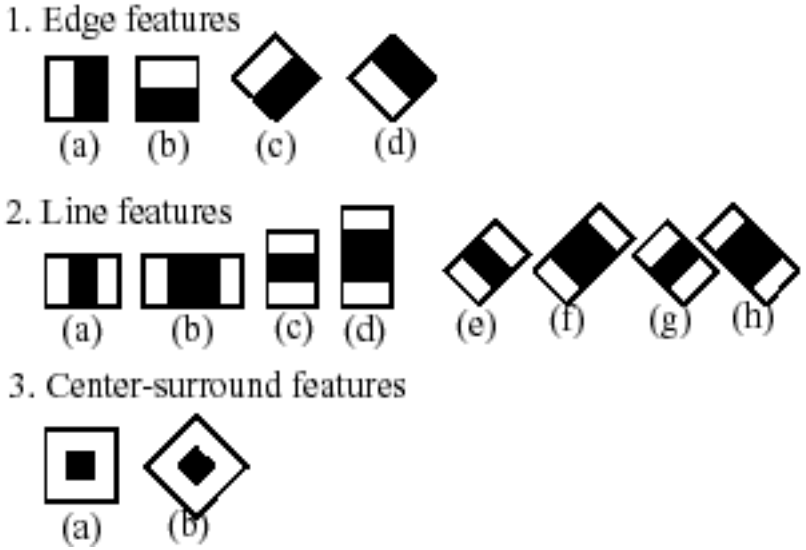
where $\alpha_t = \log \frac{1}{\beta_t}$

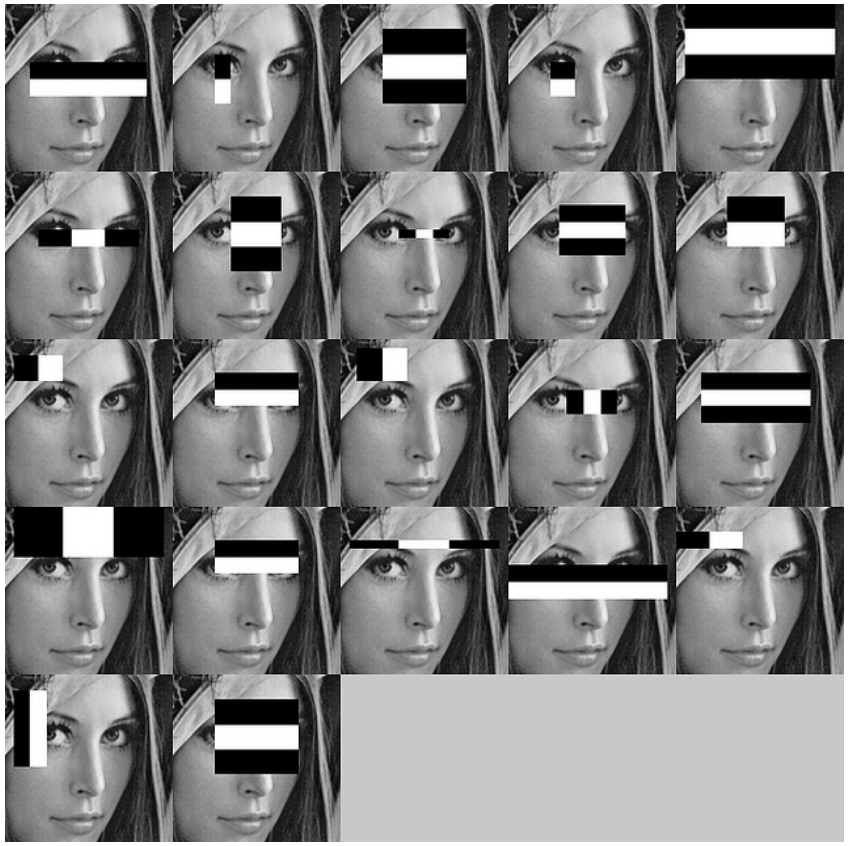
Figure 3: The AdaBoost algorithm for classifier learning. Each round of boosting selects one feature from the 180,000 potential features.

Output

Haar Classifier (xml)

Detecting Haar-like Features





You can find code to do this at :
http://www.janeriksolem.net/2009/01/pca-for-images-using-python.html

Scoring images (Eigenfaces)

Eigenface – extraction of features by principal component analysis (PCA)

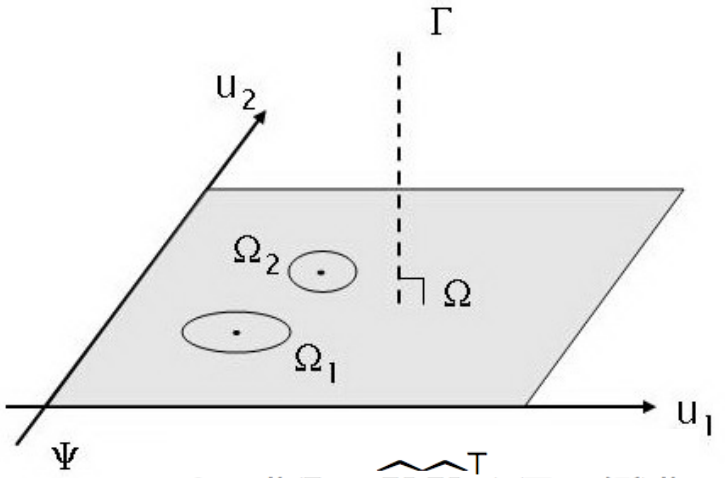
*Images need to line up
(so run facial detection first)
*transform images into a set of vectors
*compute the 'average face' and save the difference for each image
*compute a covariance matrix
*from here you can compute eigenvectors and eigenvalues, and rank them

$$\{\Gamma_1, \Gamma_2, \cdots, \Gamma_M\}.$$

$$\Psi = \frac{1}{M}\sum_{i=1}^{M}\Gamma_i$$

$$\Phi_i = \Gamma_i - \Psi$$

$$\mathbf{C} = \frac{1}{M}\sum_{i=1}^{M}\Phi_i\Phi_i^{\top} = \mathbf{A}\mathbf{A}^{\top},$$



To match up new eigenface with closest neighbor

*minimize euclidian distance

$$\Omega = \widehat{\mathbf{U}}^{\top}(\Gamma - \Psi)$$

$$\delta = \|(\mathbf{I} - \widehat{\mathbf{U}}\widehat{\mathbf{U}}^{\top})(\Gamma - \Psi)\|$$