ECE 417 MP6

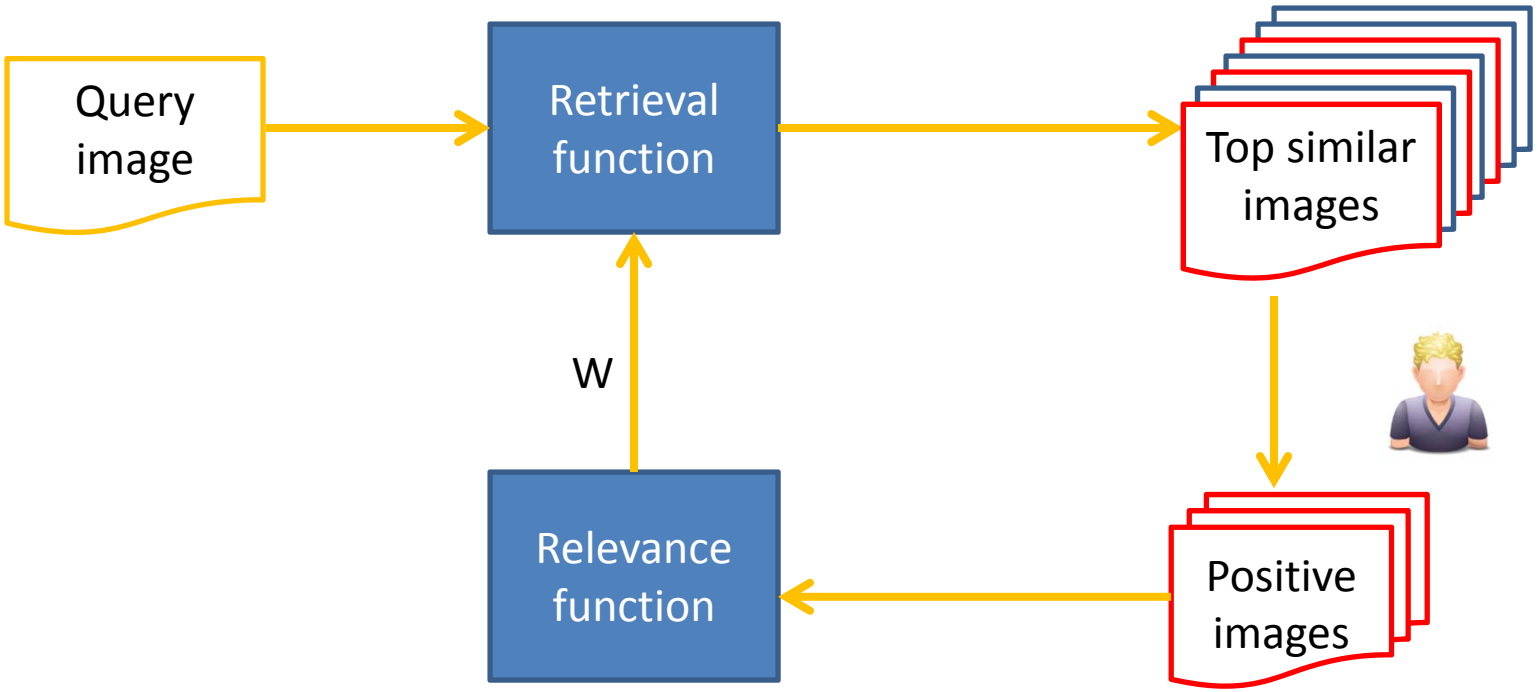
Content-Based Image Retrieval & Relevance Feedback

Overview

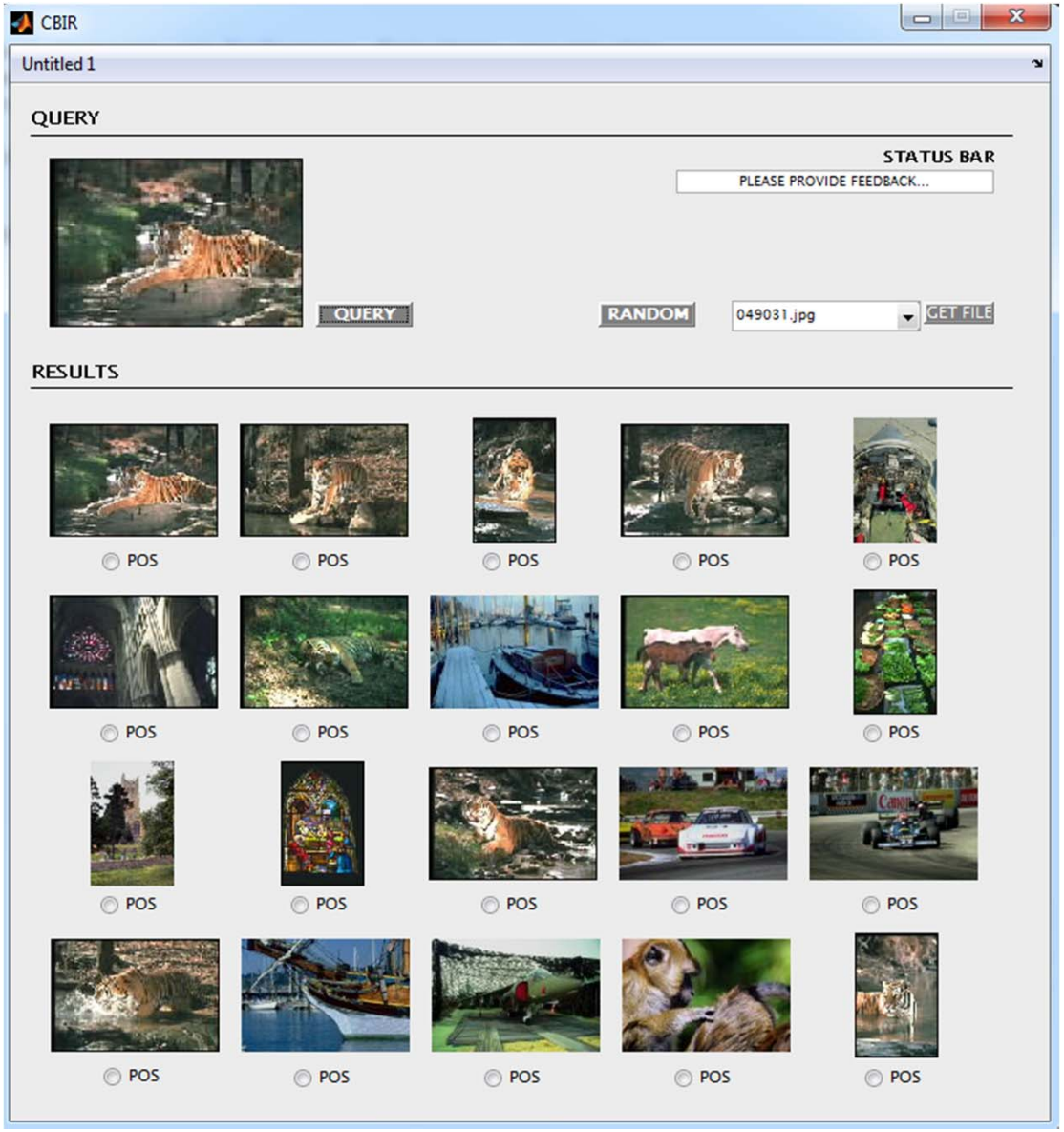
- Data
  - You are given 1400 images with their 47-dim visual feature (so you do not need to worry about feature extraction)
  - These image features are stored in [handles.META_DATA]

- Tasks
  - Implement the retrieval function for a set of query images (3.1)
  - Implement the relevance feedback function (3.2)

Your tasks


Query image
Retrieval function
Top similar images
W
Relevance function
Positive images

GUI


CBIR
Untitled 1
QUERY
STATUS BAR
PLEASE PROVIDE FEEDBACK...
QUERY
RANDOM
049031.jpg
GET FILE
RESULTS
POS

Task 1: Retrieval function

- Given several query images (including those from user feedback), return top 20 images that are visually similar to the query images
- INPUT:
  - Image features for all images (handles.META_DATA)
  - Indices of the query images (handles.posInds)
- OUTPUT:
  - Rank-sorted list of top 20 indices (handles.currentTopInds)
- 3 Subtasks:
  - Compute the mean image-feature vector for the query images
  - Compute the Mahalanobis distance between the mean query images vector to each of the images in the database
  - Sort those distances to get the indices of the top 20 similar images
- NOTE: To complete the 2nd subtask, you need the weighting matrix from Task 2. You can first simply implement Task 2 by just returning an 47x47 identity matrix from the relevance feedback function

Task 2: Relevance feedback function

- Given a set of similar images (from user's feedback), find a diagonal weighting matrix such that the features with smaller variances have larger weights and vice versa
- INPUT:
  - Image features for all images (handles.META_DATA)
  - Indices of the query images (handles.posInds)
- OUTPUT:
  - A diagonal weighting matrix (W)
- NOTE:
  - If there is no image from user feedback, you have to return an 47x47 identity matrix

Extra credit: Full weighting matrix

- Can you 'find' a full weighting matrix?
  - Inverse of covariance matrix
    - Any problem?
    - Regularized inverse of covariance matrix: $\mathrm{inv}(XX^T+aI)$
  - PCA
    - Given a set of images, find the projection matrix P such that principal components (those directions with high variance) are removed
    - $W = P^TP$ (P is a d-by-47 matrix)

Extra credit 2: Using negative feedbacks

- Can you exploit negative feedbacks as well?
  - Implicit negative feedback: those images not being selected as positive
    - Assuming all the positive images are selected as positive
  - How?
  - LDA:
    - Given a few of positive and negative images, find the projection matrix P that best separate the two groups
    - Again, $W = P^T P$ (P is a d-by-47 matrix)