An Efficient, High Quality Object Recognition System

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Object Recognition

- **Input Image**
- **Trained Categories**
- **Image Queries**
- **Outputs**
- **Object Recognition System**

Training and Classification

- **Distance computation**
  - \( I \) has regions \( r_1, r_2, ..., r_L \)
  - \( J \) has regions \( r'_1, r'_2, ..., r'_L \)
  - \( D(I \rightarrow J) = w_1d_1 + w_2d_2 + ... + w_Ld_L \)
  - \( w_i \): the weight of \( r'_i \)
  - \( d = \min(d(r'_i, r_j)) \)

- **Weight learning**
  - Formulate to a large-margin opt. problem
  - Identify representative regions in an image
  - \[
  \begin{align*}
  &\max \frac{1}{2} \sum_{i} \left( w_i y_i \right)^2 + \sum_{i} \xi_i \sum_{j \neq i} y_i y_j d_{ij}^m \geq 1 - \xi_i, \forall i = 1, 2, ..., T \\
  &\sum_{i} w_i (d_{ij}^m - d_{ij}^p) \geq \frac{1}{2} \xi_i, \forall i = 1, 2, ..., T \\
  &\xi_i \geq 0, \forall i = 1, 2, ..., T
  \end{align*}
  \]

- **Hough Voting**
  - Consider the weights of regions of exemplars
  - Generate hypotheses of bounding boxes and possible categories
  - Cluster the bounding box guesses by the mean shift algorithm

Experimental Results

- **Detection Quality**
  - Speedup by Parallel Implementation
  - **Classification**
  - **Computation time (s)**
  - **Speedup**
  - **Parallel Algorithm**
  - **Original Serial Algorithm**