Active Classification based on Value of Classifier

Tianshi Gao  Daphne Koller

Motivation:

Classification accuracy \rightarrow \text{our goal} \rightarrow \begin{align*}
\text{• Multiple features/kernels} \\
\text{• Ensemble of classifiers} \\
\text{• Good statistical power} \\
\text{• Expensive computational cost}
\end{align*}

Test time

Can we enjoy the \text{statistical gain} of using multiple features/kernels/classifiers at a \text{small computational cost}?
Active classification process:

- classification as a **sensing** problem: each classifier is viewed as a potential **observation** that might inform our classification process

- a **dynamic** process: observations are selected sequentially based on previous observations

- selection based on **value of classifier**
  - A value-theoretic computation that balances an estimate of the **expected classification gain** and its computational cost
Model/Algorithm Highlights: instance-specific, dynamic, robust, joint consideration of statistical and computational properties
Results (multiple features)

- Highest accuracy
- 26.4x speedup

Graph showing results on scene15 dataset with different features:
- sequentially adding features
- active classification
- GIST
- LBP
- spatial HOG
- Object Bank
- dense SIFT

Individual features are indicated by different markers on the graph.