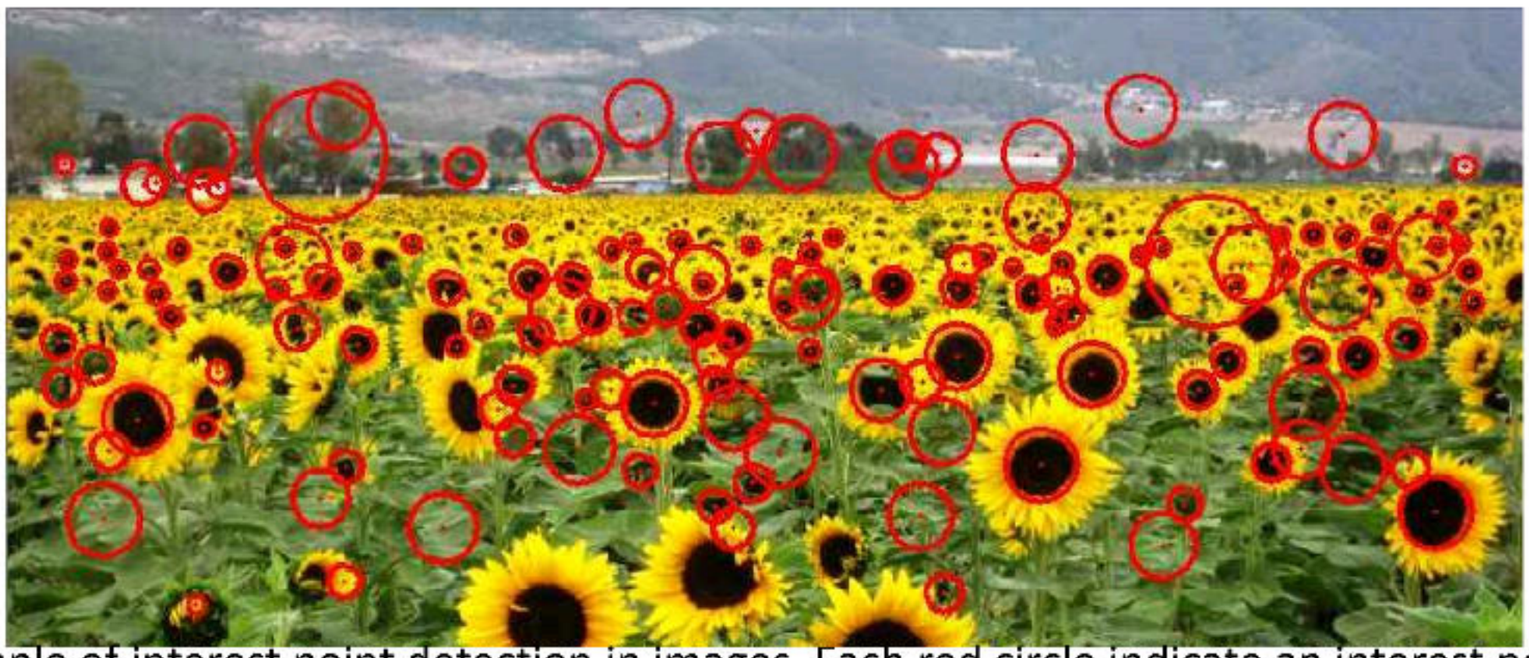
Pattern Discovery for Image Analysis

Image Representation for Visual Pattern Discovery

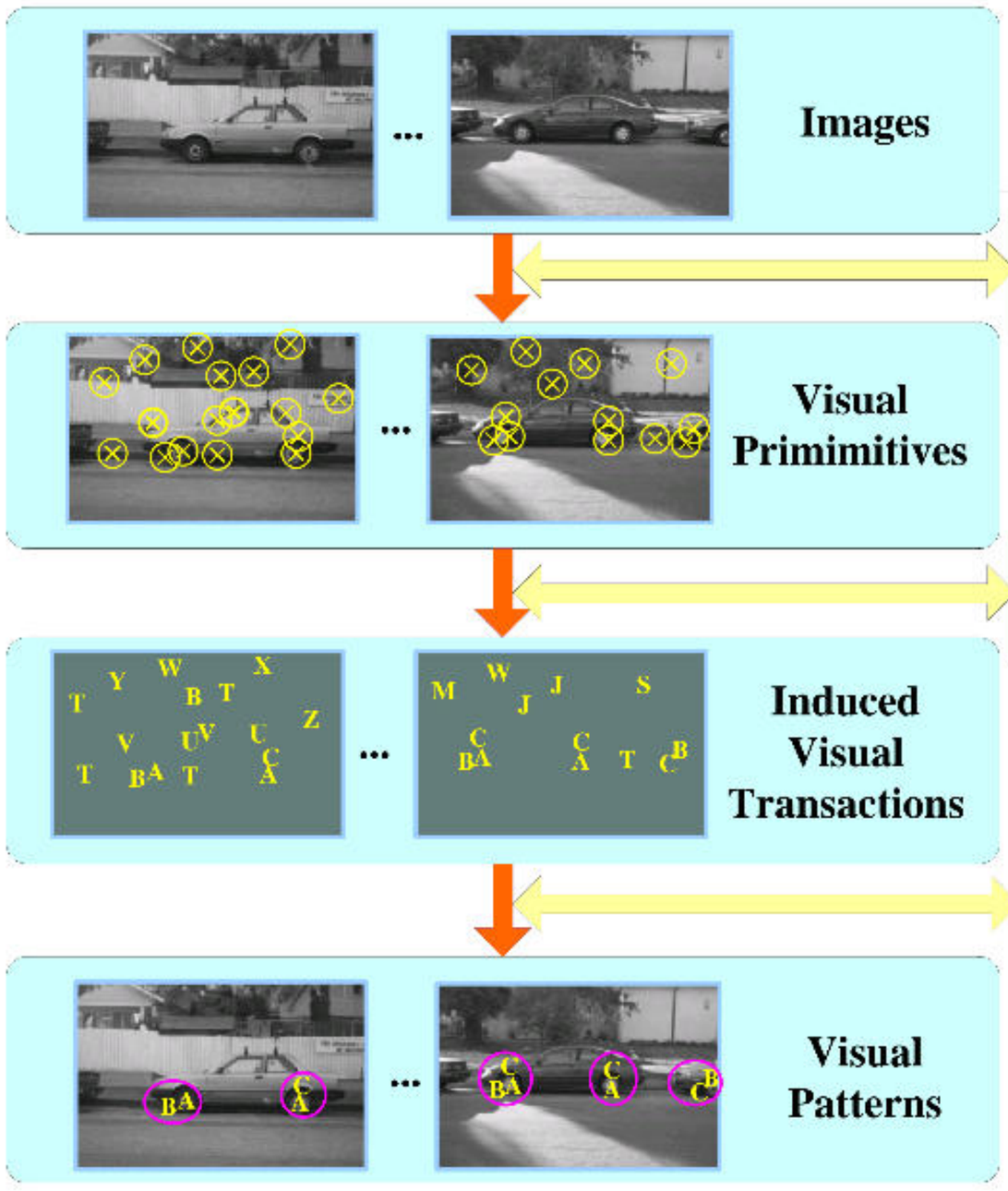
- An image can be characterized by visual primitives, e.g., interest points
  - Each visual primitive can be described by visual feature, e.g., a high-dimensional feature vector
  - Each image is a collection of visual primitives



An example of interest point detection in images. Each red circle indicate an interest point.
Image courtesy from boofCV http://boofcv.org/index.php?title=Example_Detect_Interest_Points

Courtesy of Junsong Yuan @ NTU.SG, Ying Wu @Northwestern

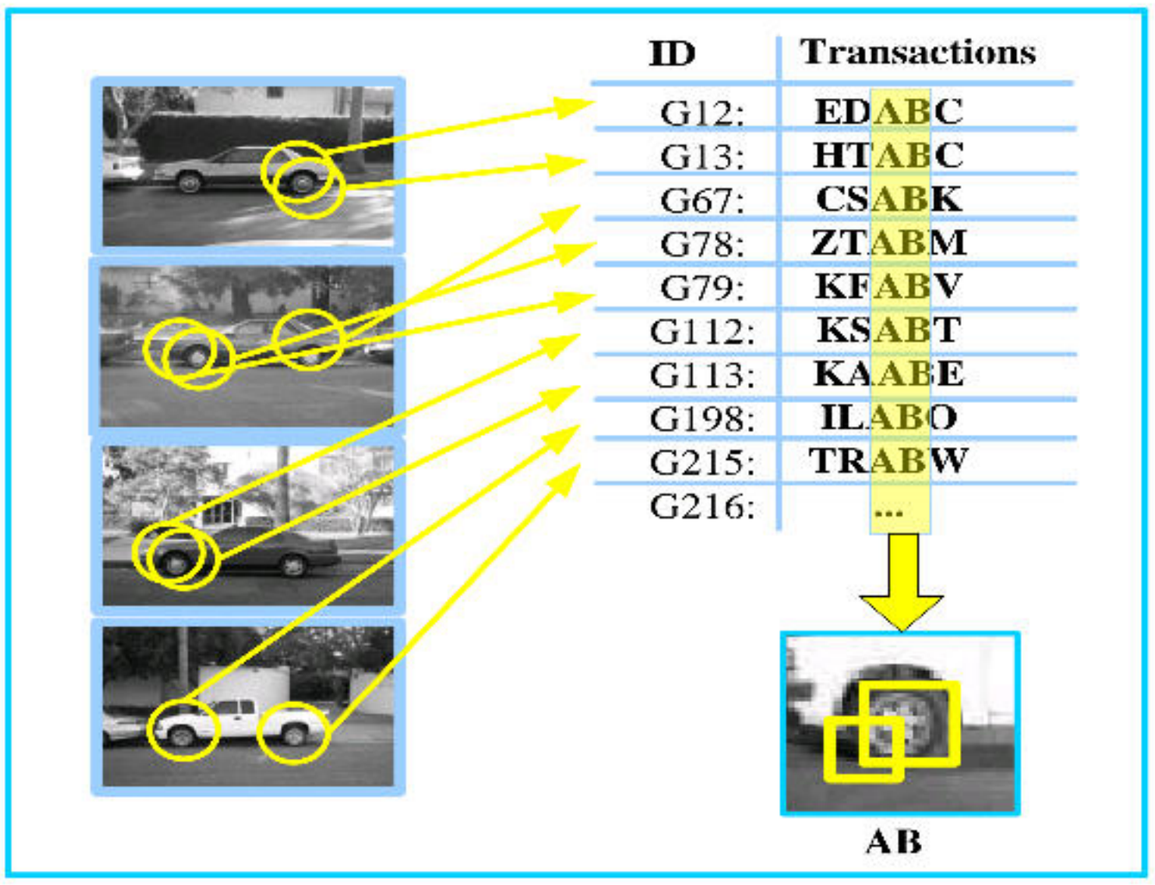
Visual Patterns Discovery



- Visual primitives can be clustered into visual "items"
  - Similar visual primitives belong to the same item
- Each visual primitive finds its k-nearest-neighbor in the image to form a visual "transaction"
  - An image can generate a number of transactions, i.e., induced visual transactions
- Mining "frequent itemsets" leads to semantically meaningful visual patterns

Courtesy of Junsong Yuan @ NTU.SG, Ying Wu @Northwestern

Challenges of Visual Pattern Discovery



- Images are spatial data
  - Spatial configuration among the visual items matters
  - Induced transactions may overlap with each other, thus one needs to address the over counting problem
- Uncertainties of visual items and patterns
  - Noisy clustering of visual primitives into visual items affects visual pattern discovery
  - Visual synonym and polysemy

Courtesy of Junsong Yuan @ NTU.SG, Ying Wu @Northwestern

Recommended Readings

- Hongxing Wang, Gangqiang Zhao, Junsong Yuan, Visual pattern discovery in image and video data: a brief survey, Wiley Interdisciplinary Review: Data Mining and Knowledge Discovery 4(1): 24-37 (2014)
- Hongxing Wang, Junsong Yuan, Ying Wu, Context-Aware Discovery of Visual Co-Occurrence Patterns. IEEE Transactions on Image Processing 23(4): 1805-1819 (2014)
- Gangqiang Zhao, Junsong Yuan, Discovering Thematic Patterns in Videos via Cohesive Sub-graph Mining. ICDM 2011: 1260-1265
- Junsong Yuan, Ying Wu, Ming Yang, From frequent itemsets to semantically meaningful visual patterns. KDD 2007: 864-873