Furniture Image Classification

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Outline

• Furniture image dataset
• Graph-based Image Classification
  – Convert Image to graph
  – Compute graph similarities
  – Classification using SVM
• Experiments results
• Conclusion and Future Work
Outline

• Furniture image dataset
Furniture Image Dataset

• 8 classes
  – Bed, Bench, Buffet Hutch, Chair, Chest, Dresser, Sofa, Table
• 200 images per class
Bed
Bench
Buffet Hutch
Chair
Chest
Dresser
Sofa
Table
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• Furniture image dataset
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  – Convert Image to graph
Connect Local Feature Points

• Compute SURF feature points
• Convert one point to one node
  – The SURF descriptor is feature vector of the node
• Connect the node using K nearest neighbors
  – Weight of edge is the distance between two nodes
Connect Tiles

• Train visual words
  – Compute dense SIFT feature of some images
  – Cluster the features using K-means
    • Cluster centroids = visual words
• Cut image to 4x4 tiles
• Compute visual words histogram within each tile
• Treat each tile as a node
  – Visual word histogram of the tile is feature vector of the node
• Connect the node using k nearest neighbors
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Shortest Path Graph Kernel (SPGK)

\[ k_{sp}(G, G') = \sum_{e \in E} \sum_{e' \in E'} k_{walk}(e, e') \]

\[ k_{walk}(e, e') = k_{node}(u, u') \cdot k_{edge}(e, e') \cdot k_{node}(v, v') \]
Unordered Neighboring Graph Kernel (UNGK)

• Given a node $v$, let us define a set $N(v)$ contains all the neighboring nodes of $v$

$$k(G, G') = \sum_{v \in V} \sum_{v' \in V'} k_{node}(v, v') \ast (\alpha + k_{neb}(v, v'))$$

$$k_{neb}(v, v') = \sum_{n \in N(v)} \sum_{n' \in N(v')} k_{node}(n, n')$$
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Results on Key-Point-Graph

![Graph showing accuracy vs. C values for different methods.](image)

- UNGK-1-GAUSSIAN-0.1
- SPGK-GAUSSIAN-0.1
- UNGK-1-GAUSSIAN-1
- SPGK-GAUSSIAN-1
- UNGK-1-GAUSSIAN-10
- SPGK-GAUSSIAN-10
- UNGK-0-INTERSECT
- UNGK-1-INTERSECT
- UNGK-10-INTERSECT
- SPGK-INTERSECT

Accuracy vs. C values graph with various markers and line styles representing different methods.
Results on Image-Tiling-Graph
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Conclusion

• Furniture Image dataset
• Graph-based image classification
  – Two image-graph conversion methods
  – Two graph kernels for similarity computation
• Best accuracy is 92%
Future Work

- More classes
- Cut each class into sub-classes
- More graph kernels
Thanks!

Questions?