# Graph Sketch Query

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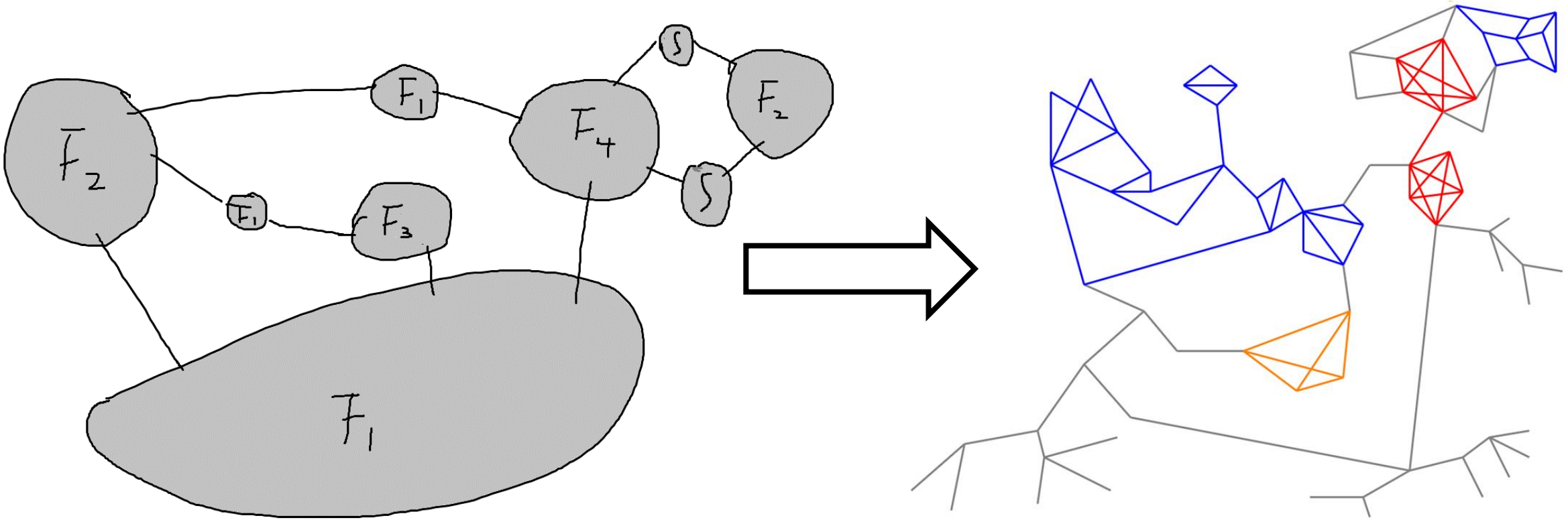
Research Mentor: Prof. James Abello

# Mentor Information

- **Research Mentor:**
  - Prof. James Abello
- Research Mentor Feedback:
  - Project needs more learning aspect
    - Changed the project goal as a image recognition and similar search problem.

# Problem Statement

- Query Graph Cities by hand-drawn sketches.
  - Given an input image of hand-drawn sketches that describes the gluing of fixpoints (subgraph whose k-core is itself), check if there is any graph satisfying the description.

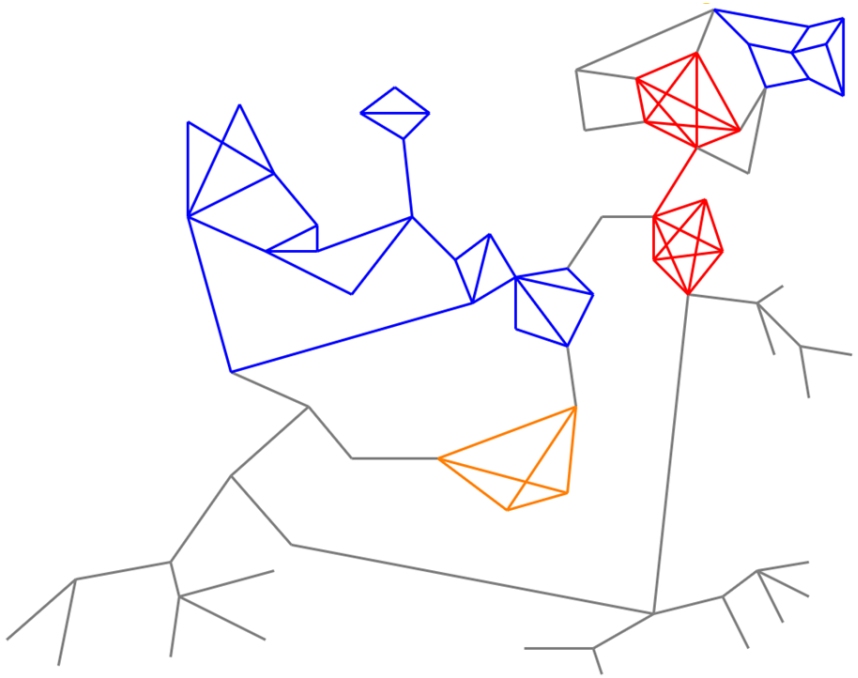


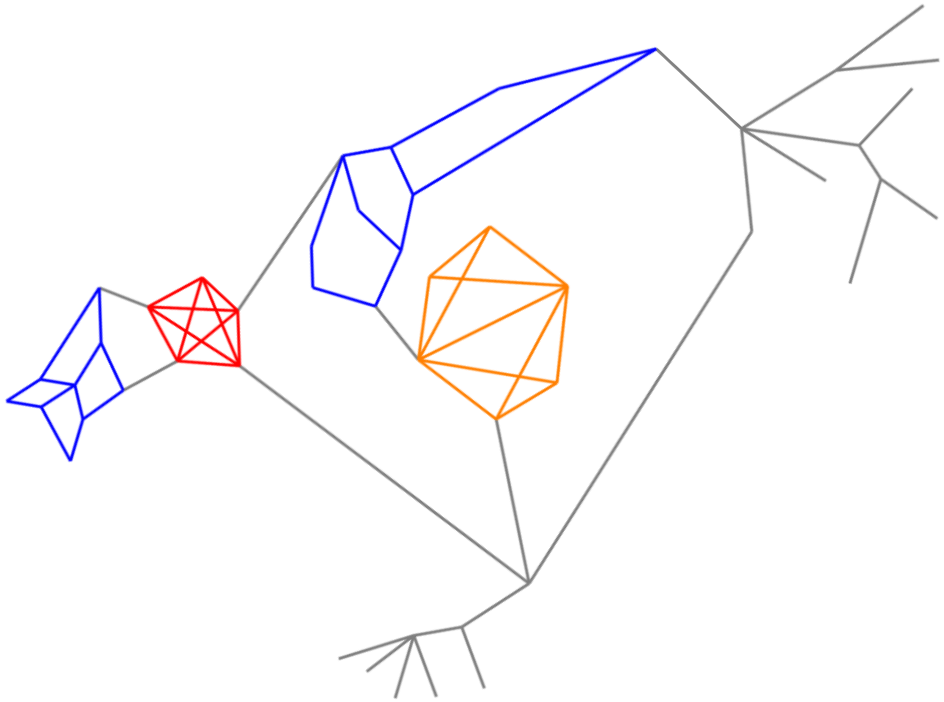
# Motivation

- Given a layout of a graph, and its decomposition, users can easily draw a sketch.
- However, the reverse problem is hard. Given a sketch, find whether a graph exists in the database that corresponds to the sketch.
  - Recognition of a sketch.
  - Clustering the output of recognition into database.

# Applications

- Compare two graphs if they share a similar macro-structure.
  - As a way to differentiate two graphs.
- Help user quickly find all graphs with special macro-structure.
  - Generalize semantics findings from one graphs to another graph.





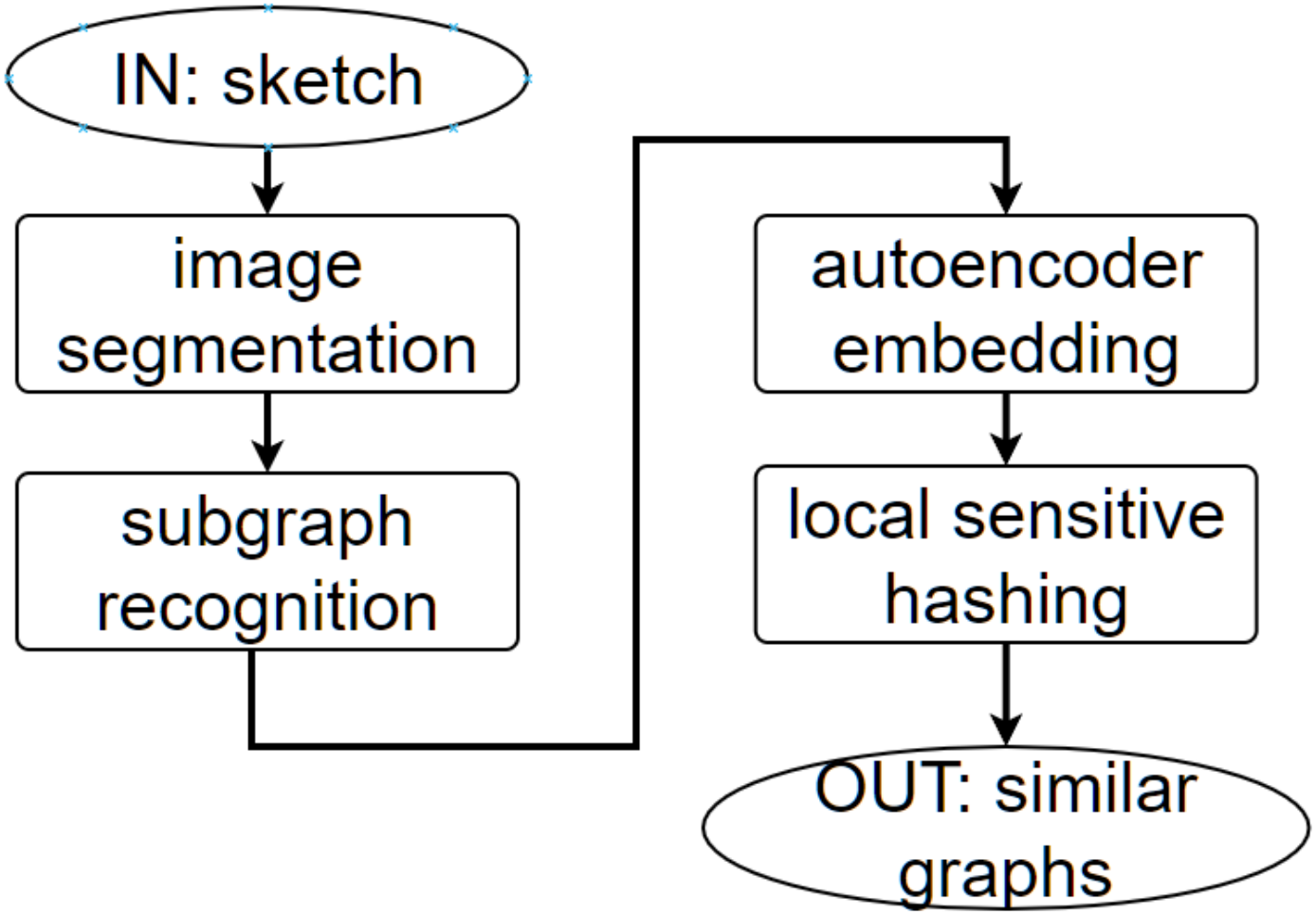
# Challenges

- Recognition
  - Segmentation of input sketches into subgraphs and the gluing between subgraphs.
  - Recognition of each sketch of subgraphs.
- Clustering
  - Unique representation of a macro-structure.

# Prior Work & Limitations

- Seddati, O., Dupont, S., & Mahmoudi, S. (2015). DeepSketch: Deep convolutional neural networks for sketch recognition and similarity search. 2015 13th International Workshop on Content-Based Multimedia Indexing (CBMI), 1-6.
  - The input image is treated as a whole, which cannot keep the gluing information between subgraphs.
- Zhang, Jianshu, Jun Du, and Lirong Dai. "Multi-scale attention with dense encoder for handwritten mathematical expression recognition." *2018 24th international conference on pattern recognition (ICPR)*. IEEE, 2018.
  - Cannot handle sketch information.

# Proposed Approach



# Contributions

- A way to segment sketches, and recombine the recognition of all segmentations.

# Evaluation

- Recognition
  - Accuracy of segmentation
  - Accuracy of recognition of subgraphs
  - Accuracy of generating macro-structure (by adding a small decoding network)
- Clustering
  - Accuracy of auto-encoder decoding
- Overall
  - Top-k recall and precision

# Benefits

- Separate the sketch into “meta-nodes” and “meta-edges”, and recognize them independently to encode the macro-structures.

# Expected Deliverable

- A network that input a sketch of a fixed resolution, output the name of graphs that have corresponding macro-structure.

# Reference


- Seddati, O., Dupont, S., & Mahmoudi, S. (2015). DeepSketch: Deep convolutional neural networks for sketch recognition and similarity search. 2015 13th International Workshop on Content-Based Multimedia Indexing (CBMI), 1-6.
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# Thanks