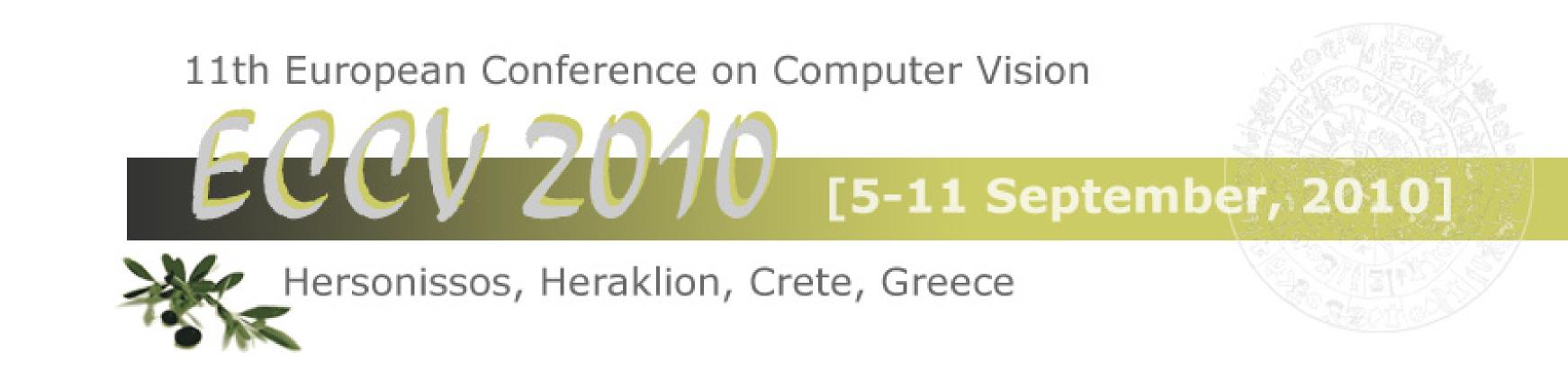# Location Recognition Using Prioritized Feature Matching

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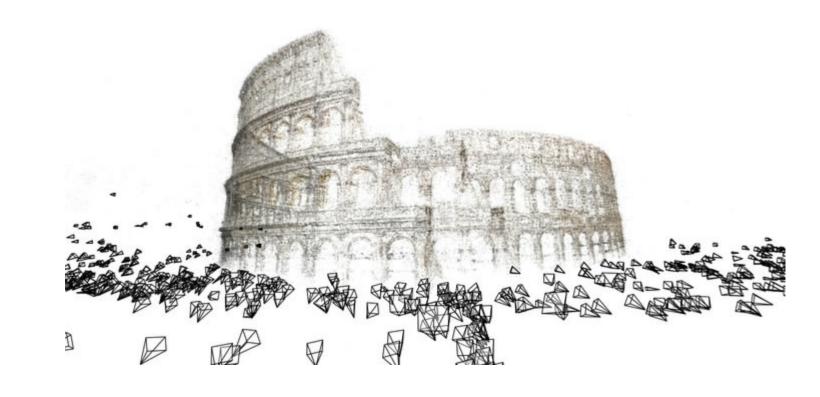
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Motivation

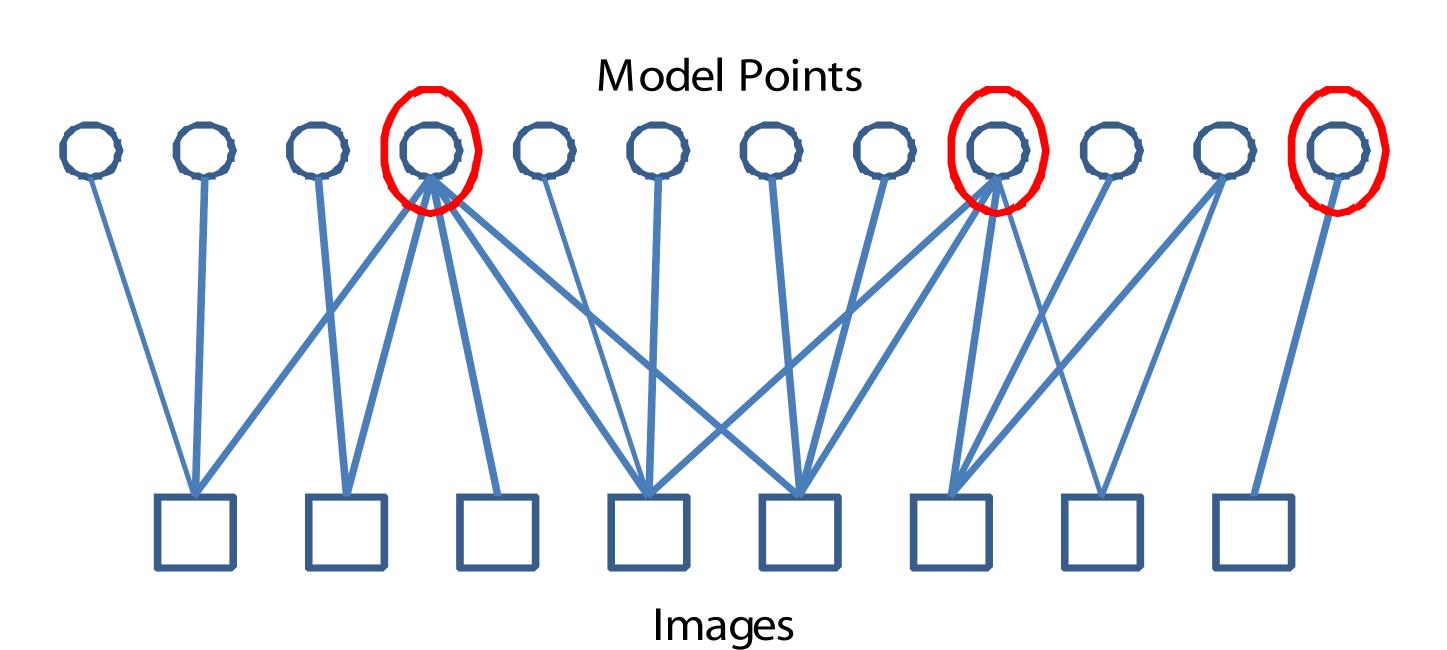- 3D reconstruction techniques increasingly powerful (e.g. [Agarwal et. al. ICCV 09])

- Idea: Use reconstructred 3D models to register (and localize) new query images

- Can estimate camera pose if can find enough matches between model points and image features
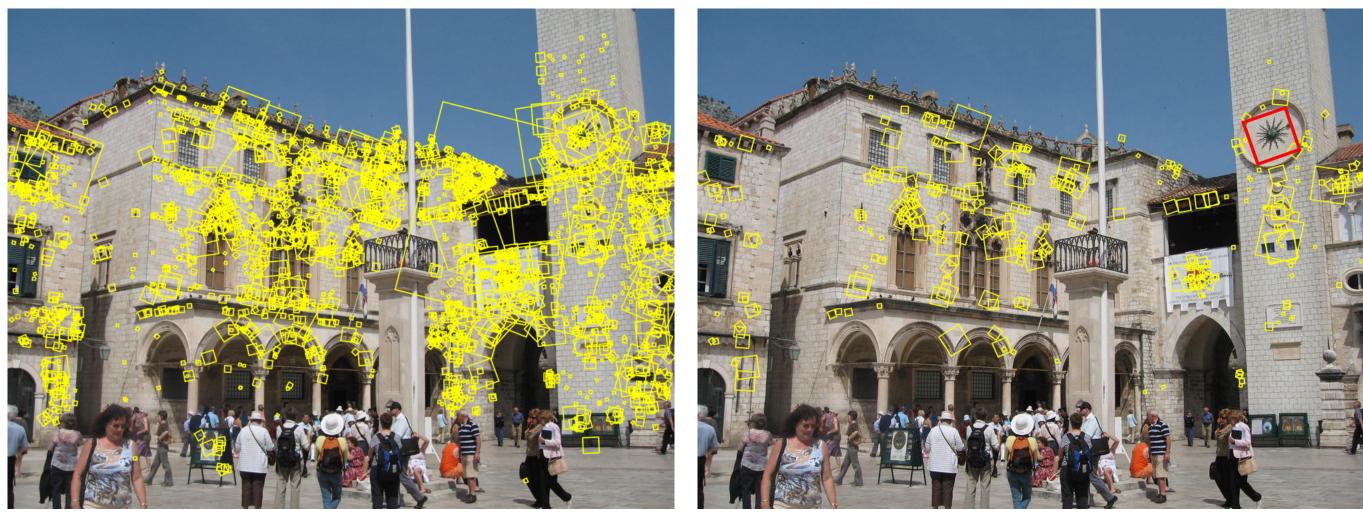
Model Compression

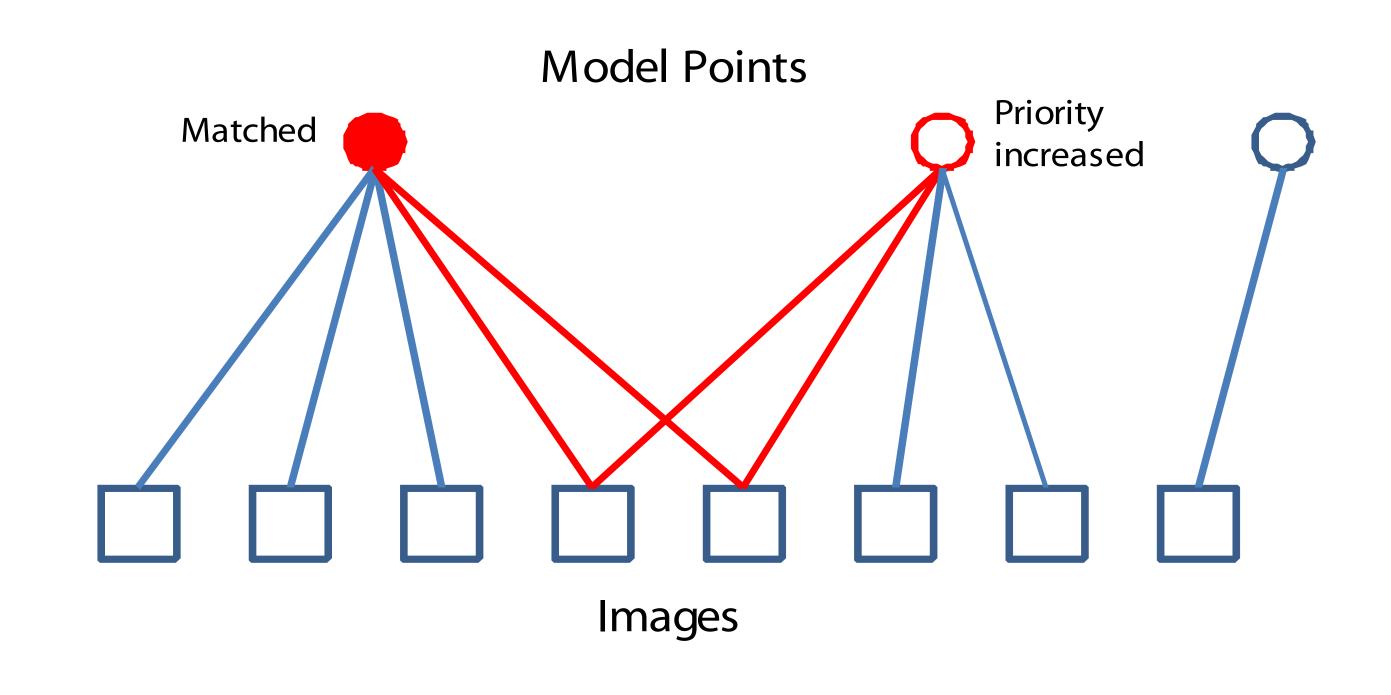- Images & model points form visibility graph -- bipartite

Model Points

Images

- Find the most compact subset of model points that "cover" all the images a given number of times
- Equivalent to set (multi)cover problem
  - In our case, multiplicity = 100

Full model   Compressed model

Prioritized Matching of Model Points to Image Features

- Conventionally: match query image features to model points ("F2P")
- Our approach: match model points to image features ("P2F")
  - Advantage: Exploit model's structural information
- When a model point is matched (to some feature in the query image), boost the priority of its "nearby" points
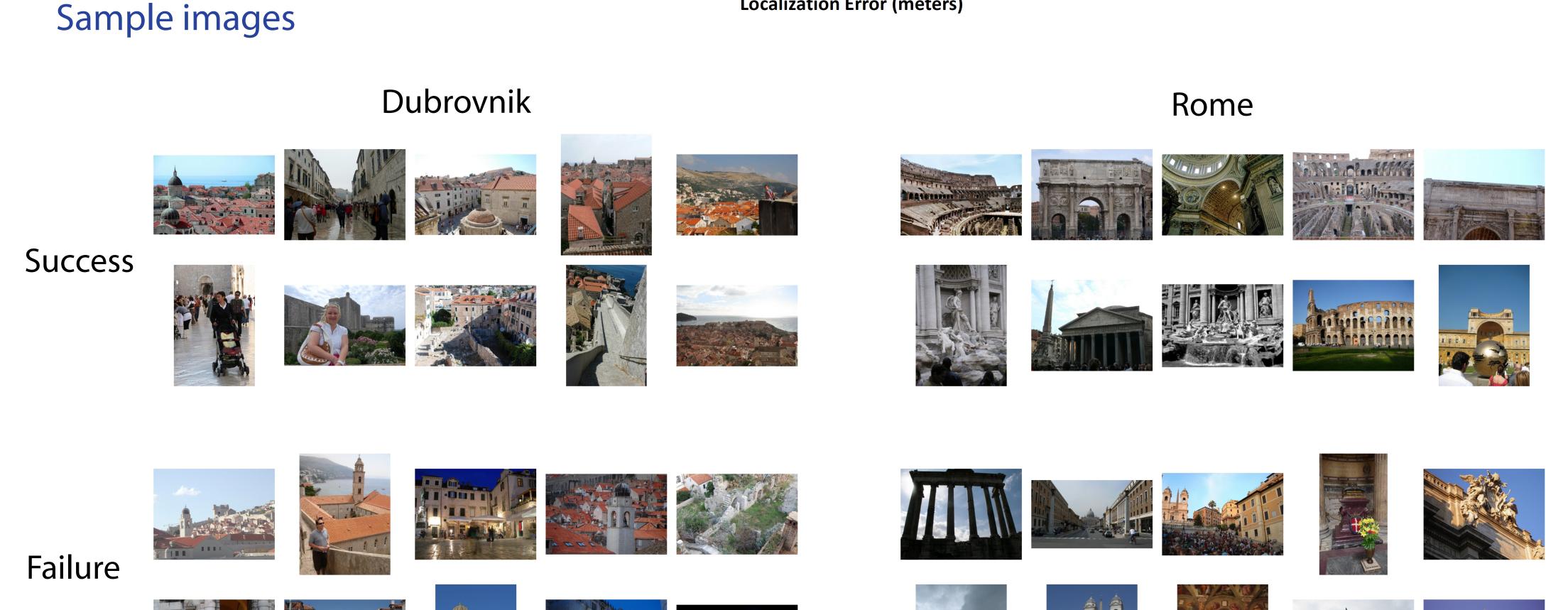
Model Points

Matched   Priority increased

Images

- Choose model point with highest priority as next match candidate
  - Initial priority ∝ degree (i.e. visibility) of the point
  - A highly compact "seed" set is considered first
  - Stop after N matches found (N=100 in our case)
- Benefits:
  - Finds true matches more quickly
  - Help avoiding false matches

Experiments

"P2F" -- our technique   "Vocab. tree" -- [Irschara et al. CVPR'09]

Percentage of Relevant Images Registered for Dubrovnik (left) and Rome (right)

Average Number of Approx. Nearest-neighbor Queries per Image for Dubrovnik (left) and Rome (right)

■ For images successfully registered ■ For images that failed to register

Registration performance in terms of the percentage of relevant test images successfully registered (out of 800 for Dubrovnik and 1000 for Rome). Higher is better. (The graph corresponds to the numbers in the "Images registered" column of Table 2 and 3, for the compressed model and the vocabulary tree.)

Computational cost, in terms of the average number of approximate nearest-neighbor queries per image, for point-to-feature matching. Lower is faster. (The graph corresponds to the numbers in the "NN queries by P2F" column of Table 2 and 3, for the compressed model and the vocabulary tree.)

Localization performance

Percentage of images within a given Error (for "Dubrovnik")

Sample images

Dubrovnik   Rome

Success

Failure

Visualization of registration and localization