Automatically Identifying and Georeferencing Street Maps on the Web

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Outline

- Introduction and Motivation
- Overall Approach and Algorithms
- Experimental Results
- Related Work
- Conclusion and Future Work

Introduction and Motivation

- Various street maps are available on the web, but many of them
  - cannot be easily distinguished with other images
  - lack of the metadata that describes the geocoordinates and scales

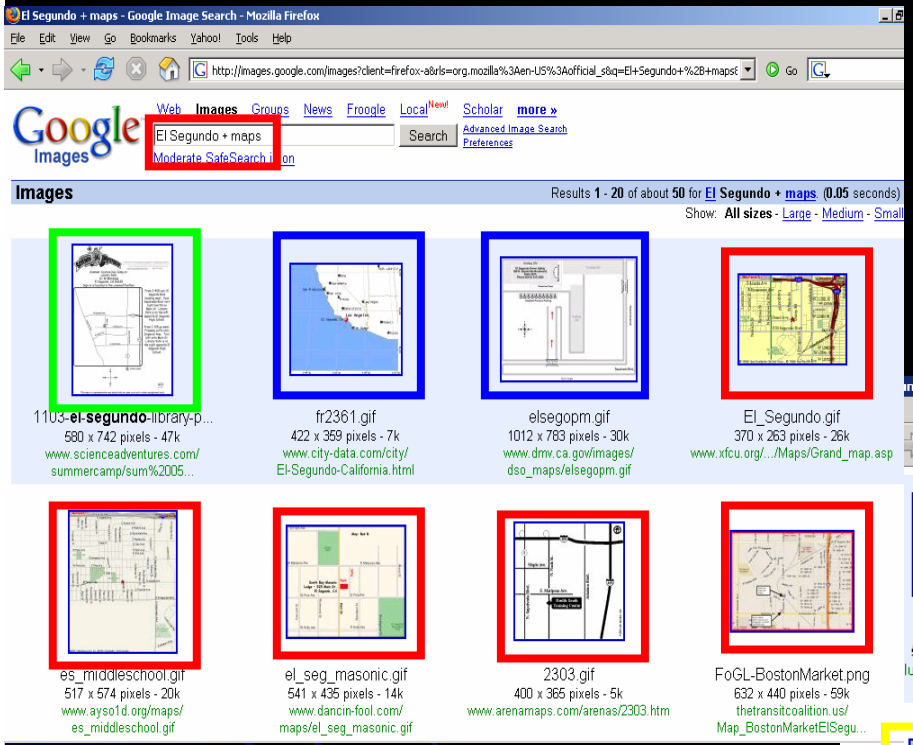
Introduction and Motivation

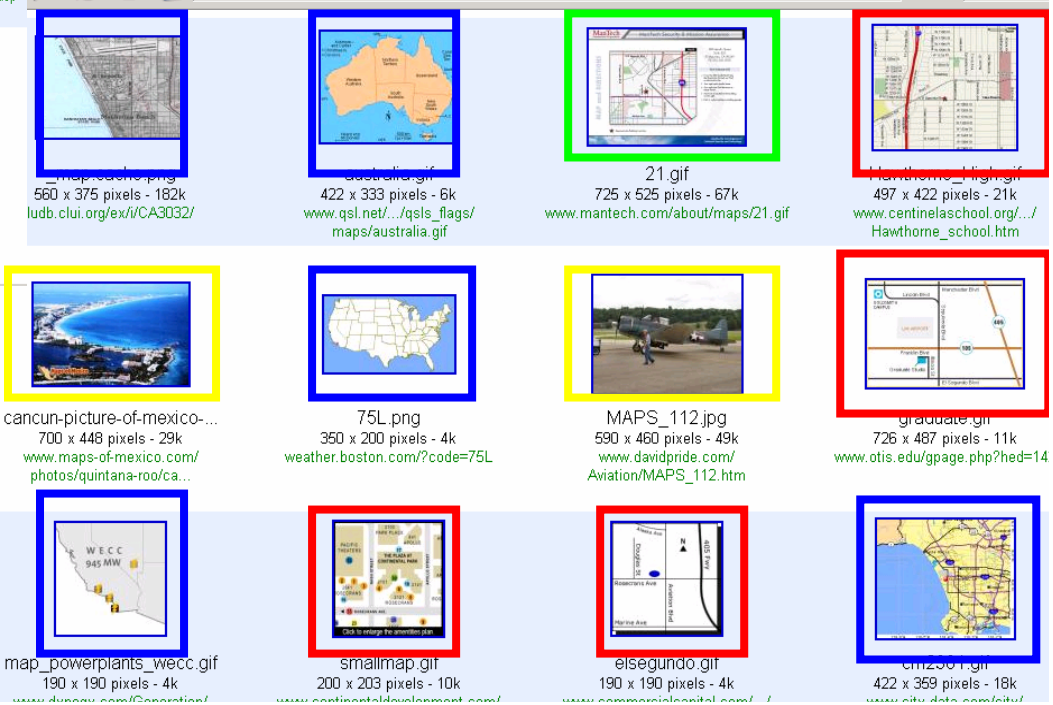
Street Maps

Scanned Documents

Photographs

Political, state, area maps





- **Non street maps :**
  - **Irrelevant for the applications that seek only street maps**
- **Street maps :**
  - **lack of metadata**

Introduction and Motivation

- In this work, we
  - identify the street maps among different images
  - apply our previous work to automatically extract road intersections from the street maps (Chiang et al.)
  - apply conflation techniques to find the geocoordinates and align the streets on the maps with imagery (Chen et al.)

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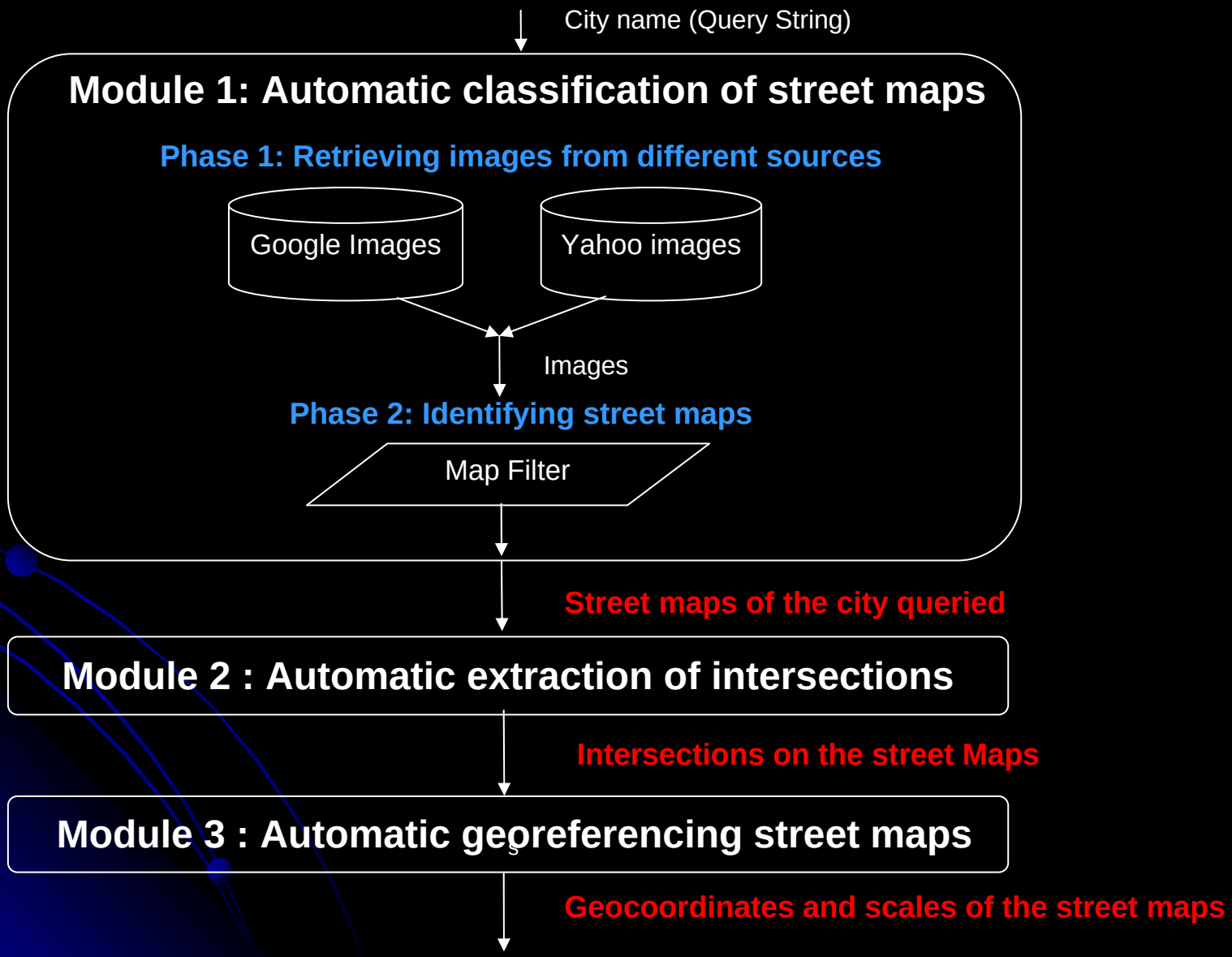
Overall Approach



Identifying Street Maps

- **Law's Texture Classification Algorithm**

(K. Laws. 1980)

- Street maps have the unique textures
  - lines, labels, characters
- Generate 75 different attributes (25R,25G,25B) to distinguish these textures on the images.

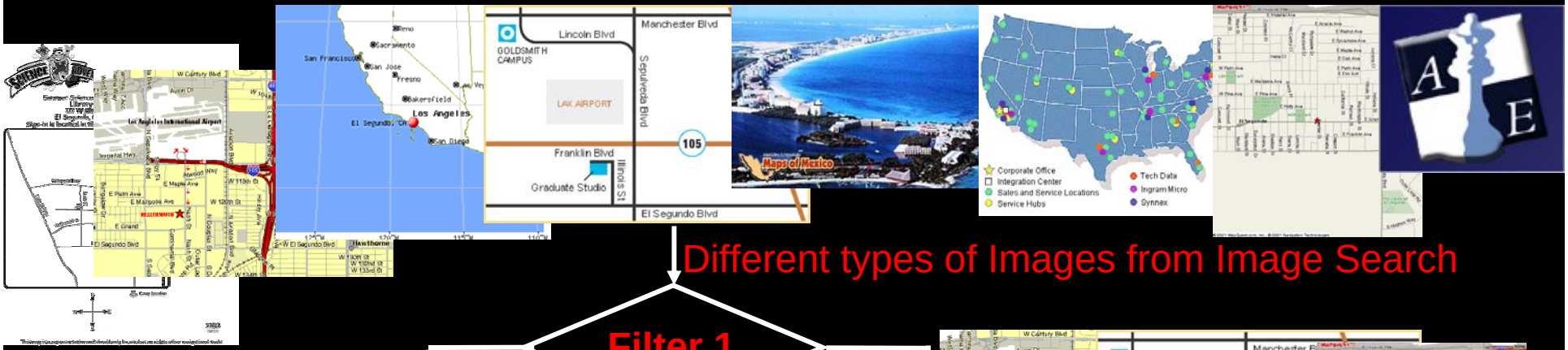
Identifying Street Maps

- (note) **SVM*light* V2.0 Support Vector Machine**

(T. Joachims, 1999)

- Training :
  - We provided 1150 different positive and negative examples of images
  - 75 attributes per image
- Classification:
  - Using the trained SVM model to classify test images

Identifying Street Maps



Different types of Images from Image Search

Filter 1

Street Maps

Filter 2

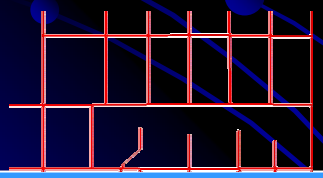
Photographs, scanned docs, Political, area climate maps, icons (Non Street Maps)

Dense and Sparse Street Maps

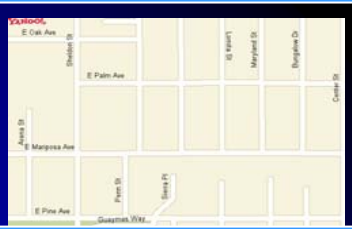
Detailed Street Maps

Georeferencing Street Maps

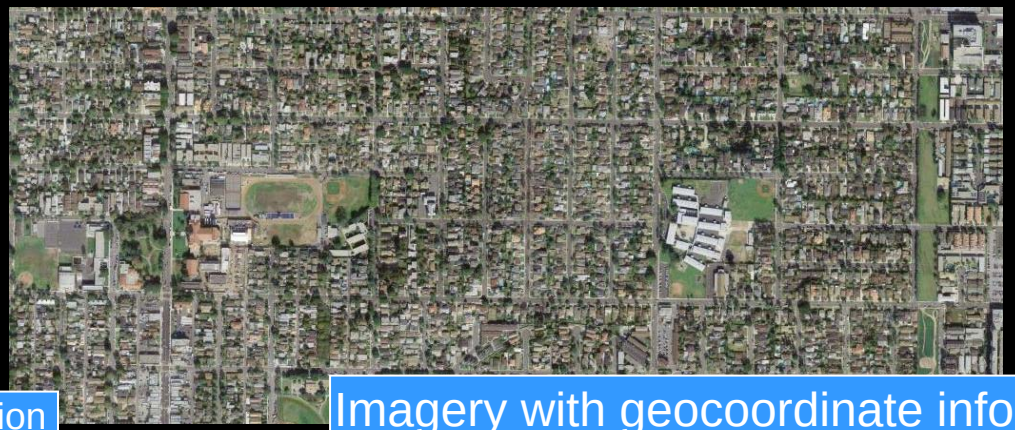
- In our previous work:
  - Automatically and Accurately Conflating Orthoimagery and Street Maps (Chen et al.)
    - Integrate raster map and other sources.
    - Utilize the layout of the road intersections within a local area to determine the map's location.



Vector data with geocoordinate information



Raster map without geocoordinate information



Imagery with geocoordinate information

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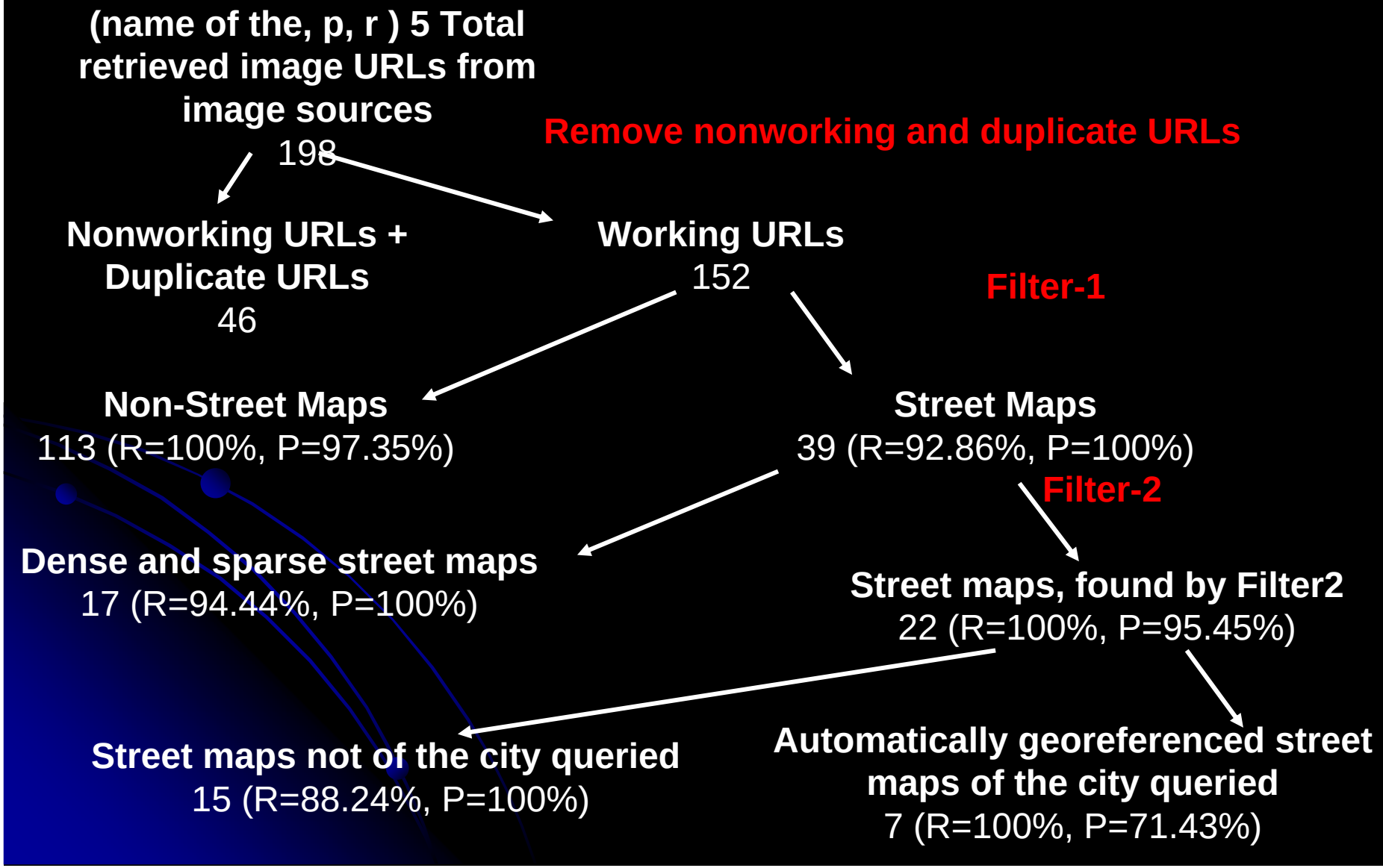
Experimental Results



Experimental Results

- On the stage of
  - Identifying street maps,
    100% recall, 95.45% precision
  - Georeferencing,
    100% recall, 71.43% precision
- The average computation time for identifying one street map
  29.65 seconds

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Related Work

- *"Functionality Based Web Image Categorization."* *Hu et al.*
  - Focus on frequency domain and image features like uniformity, size and aspect ratio. (put the difference)
- *"Webseer: an image search engine for the world wide web."* *Frankel et al.*
  - Searching images by image context (file name-type-size and color depth) and by content based tests (put the difference)

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Conclusion and Future Work

Main Contribution:

- Identification of the street maps (precision = 95.45%)
- Automatically georeferencing street maps (precision = 71.43%)
  - determine the geocoordinates, scales
  - align the map with satellite imagery

Conclusion and Future Work

We plan to :

- Classify the images into categories
  - political maps
  - weather maps
  - etc.
- Reduce the number of feature dimensions
- Combine OCR-related techniques

Thank you