

# 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

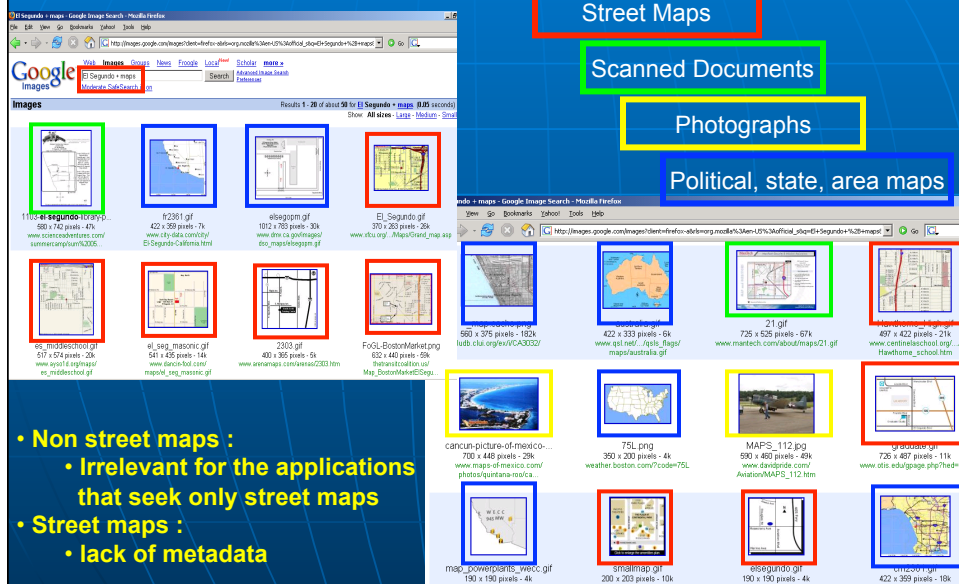
## Introduction and Motivation

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

## 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.)

# Introduction and Motivation



The screenshot shows a Google Images search for 'Segundo + maps'. The results page displays a grid of various map images. Several images are highlighted with colored boxes: a red box around a street map, a green box around a scanned document, a yellow box around a photograph, and a blue box around a political, state, or area map. The search results include various map types, including street maps, political maps, and scanned documents.

**Street Maps**

**Scanned Documents**

**Photographs**

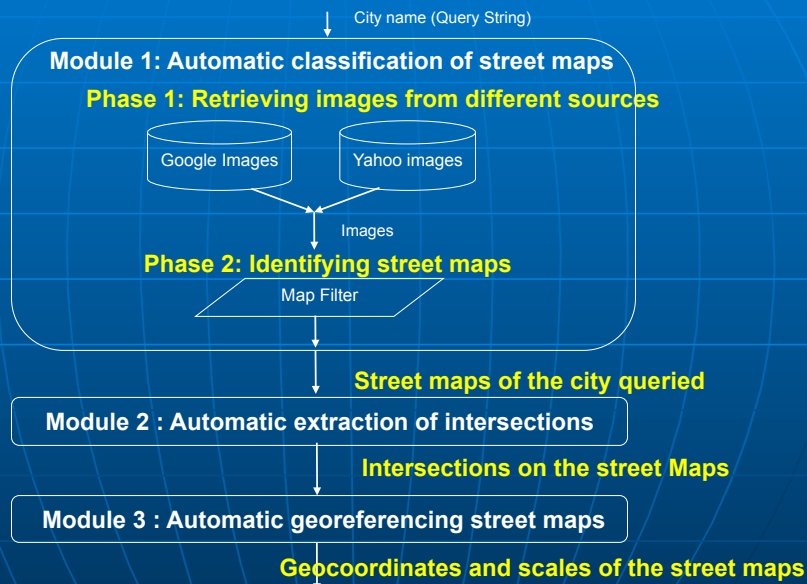
**Political, state, area maps**

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

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# Overall Approach



## Identifying Street Maps

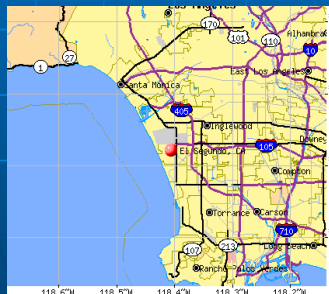
- **Law's Texture Classification Algorithm**

(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

## Law's Texture Classification Algorithm (K. Laws. 1980)

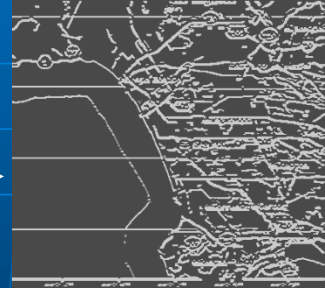
- Use different types of masks on the image to identify different textures for example,
  - For horizontal lines :



Original Image

-1	0	-1
2	0	2
-1	0	-1

Apply mask



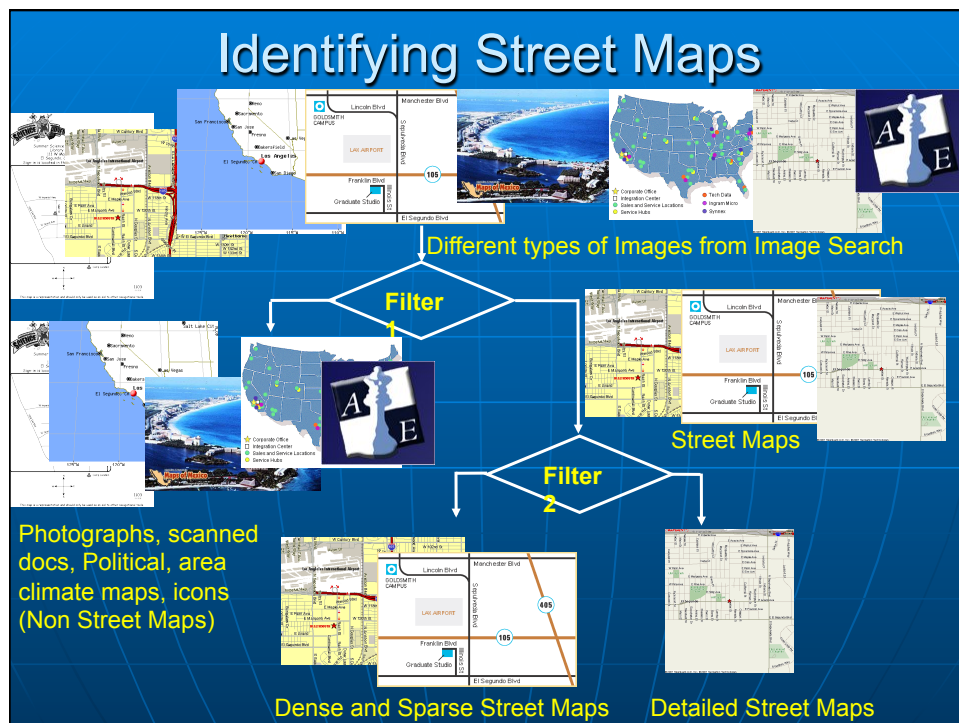
Resulting Image with horizontal lines

## Identifying Street Maps

- **Support Vector Machine** (Joachims, 1999)
  - Machine learning classification
  - Given training examples labeled either "**yes**" or "**no**", SVM creates a hyperplane to separate data into two classes
  - The dimension of the hyperplane is the number of attributes

# Identifying Street Maps

- We train on one set of images and test on a separate set of images
- 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



# Georeferencing the street maps

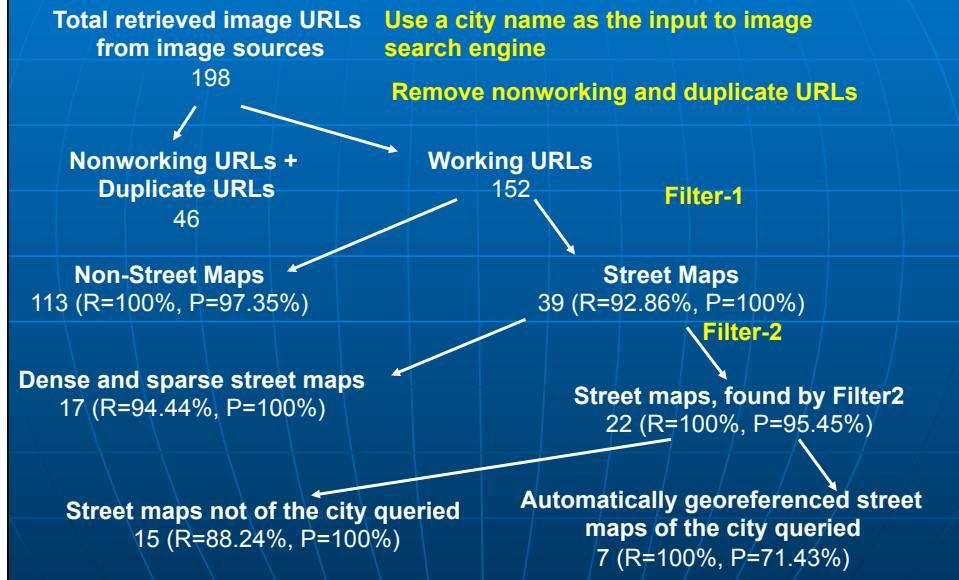
- In our previous work:
  - Automatic Road Intersection Extraction From Raster Maps (Chiang et al.)
  - Automatically and Accurately Conflating Orthoimagery and Street Maps (Chen et al.)
  - We utilize the **layout of the road intersections within a local area** to integrate imagery, raster maps and vector data



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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.*
  - Focuses on frequency domain and image features such as uniformity, size, and aspect ratio
  - **These features are not sufficient to distinguish different types of map**
- *“Webseer: an image search engine for the world wide web.” Frankel et al.*
  - Exploits image context (file name, size, type) and contents (most common color, color saturation and intensity )
  - **These features are not as reliable as the image texture used in this work**

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## Conclusion

### **Main Contribution:**

- Identification of the street maps
- Automatically georeferencing street maps
  - determine the geocoordinates, scales
  - align the map with satellite imagery

## Future Work

We plan to :

- Classify the images into categories
  - political maps
  - weather maps
  - etc.
- Incorporate character recognition techniques

Thank you