Reading Street Signs
Using a Generic Structured Object Detection and Signature Recognition Approach

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Outline

2

• Overview of our Framework
• Detection
• Text Segmentation
• Recognition
• Conclusion and Future Work
• Offline Demo
Overview: Mobvis:

Vision Technologies and Intelligent Maps for Mobile Attentive Interfaces in Urban Scenarios
Overview: Street Plate Detection
Our Contributions:

- Design an efficient system to combine
  - Structured region detection
  - Text segmentation
  - Text recognition
- Providing a database and evaluation over the database
Introduction to:
KTH-Plate Database

Figure 1: Streets included in the database are marked as red in the map of Graz city. The long tilt street is Herrngasse.
Introduction to:
KTH-Plate Annotated Database

- 86 low resolution using Mobile phone Camera (1280×960)
- 120 high resolution (2448×3264)
- 3 scales × 3 orientations
- Manual plate segmentation

**Locations:**
- 1) Graz, Austria
- 2) Stockholm, Sweden
- 3) Theran, Iran
Annotation

- Four corners of the plate
- Clockwise starting from up-left
- Ground-truth is generated
- Ground-truth plates are added to positive samples
- Random regions are added to negative set
Step 1: Detection

- Boosting method (simple Haar features)
- Affine normalization

- Generate training samples
  - Add false positives to negative set
  - Add the detected plates with over 80% overlap
- Boosting is retrained on the enriched database
Step 1: Detection

Filtering

• Still many false positives

• Hard samples

• Texture-Transform (A. Tavakoli et al.)

• Again boosting
Step 1: Detection
Final Decision

- Weighted merging

\[
\begin{align*}
S_{\text{ground truth}} \quad & \quad \bigcap \quad S_{\text{detected window}} \\
S_{\text{ground truth}} \quad & \quad \bigcup \quad S_{\text{detected window}}
\end{align*}
\]
Step 1: Detection
Sample Results
Step2: Text Segmentation

- **Input:** detected region

- **Output:** interested text region

- **Hard aspects:**
  - All text is not interesting
  - Limited detection/object overlap
Step 2: Text Segmentation

- Pixelwise texture classification
  - Two class (text/background)
  - Single Histogram (F. Schroff et al.)
  - Distance map
- Connected component labeling
  - Multi threshold
  - Bounding box around the largest component is returned
Step3: Recognition

Overview

- **OCR**
  - Needs clearly segmented characters

- **Template Matching methods**
  - **SIFT**
  - Dynamic Time Warping (DTW) of a signature
    - Real time
    - No training is needed!
    - Target models are generated simply
Step 3: Recognition
(DTW scheme)
Step 3: Recognition
(DTW scheme)

- $O(d \times N^2)$
- Sequential data (e.g. time varying)
- Projected features
Step 3: Recognition

Projected features

- Projected along the text

- Different types of features
  - Sum of intensity values
  - Upper contour
  - Lower contour

- More sophisticated features
  - Edge orientation (HOG)
Step 3: Recognition
Once again filtering

Regions detected as plate

Segmented text regions

Some samples recognized successfully
Step 3: Recognition

- Automatic model construction
  - Bag of characters

Request for the model of "Murgasse" st.

- List of street names could be used
- Remarkably invariant to font
Recognition

Evaluation

- Recognition Acc: 99.53% for 100 models
- Practically we do not need to explore more models
Google MyLocation
Future Works

- Perspective effect
- Generalized for any sign detection
- Recognition is good enough. Our bottleneck is on detection
- Needs to be faster
- Integrate to mobile application
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