

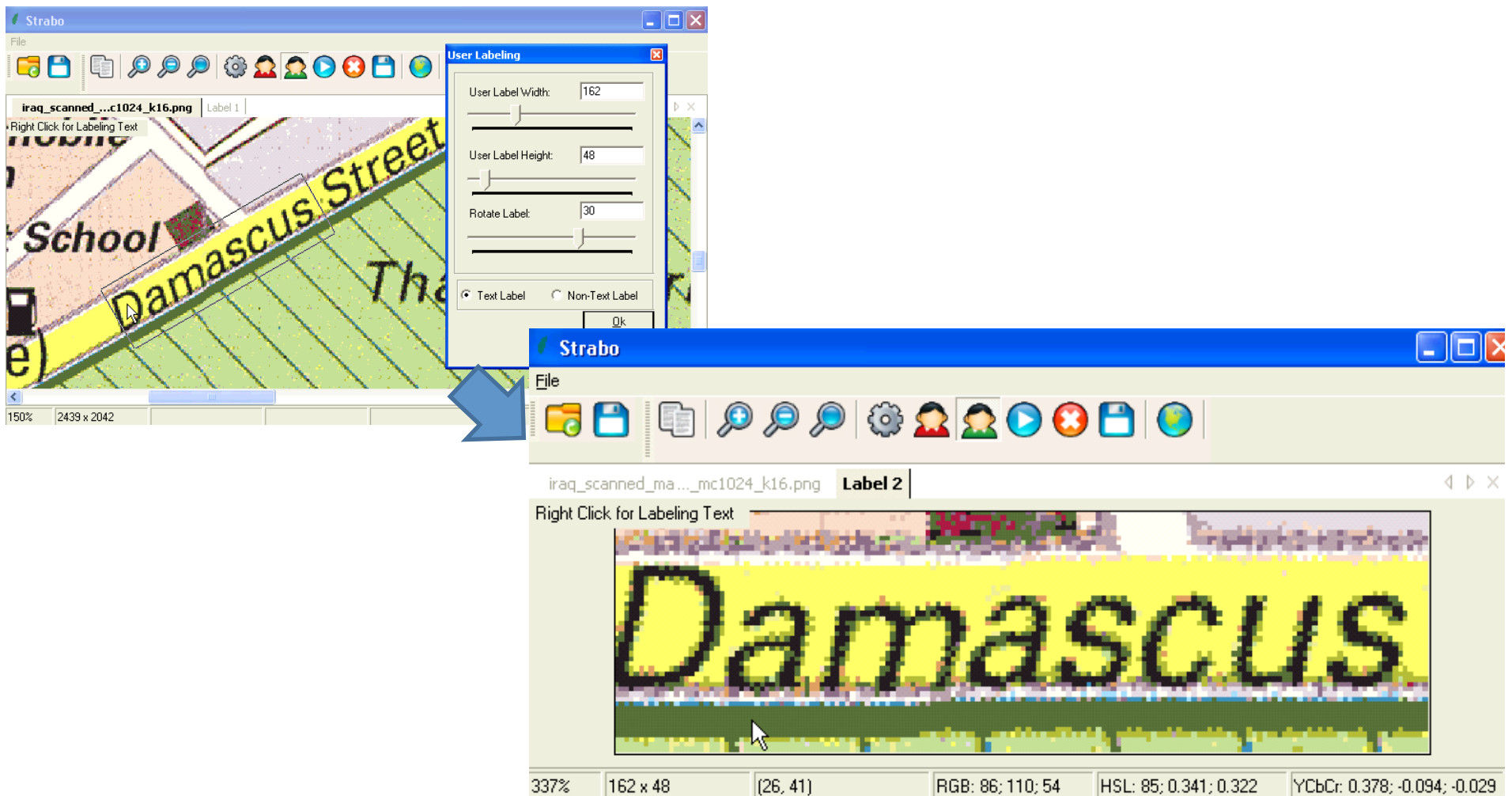


Recognition of Multi-Oriented, Multi-Sized, and Curved Text

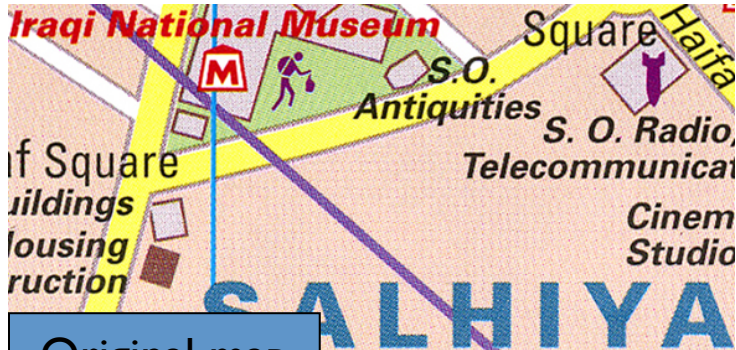
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Interactive Extraction of Text Pixels

- Use color segmentation to reduce the number of colors
- User provides examples of text areas for identifying text colors



Extracted Text Pixels



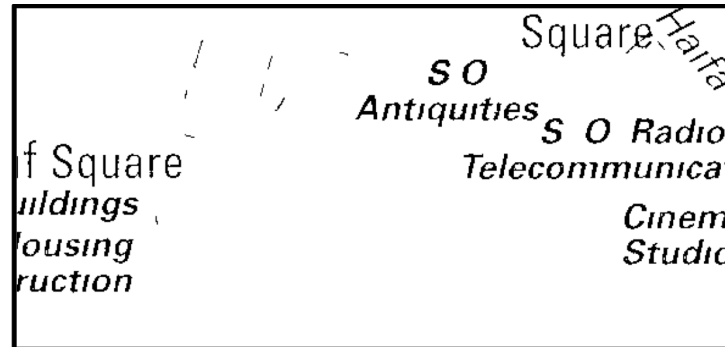
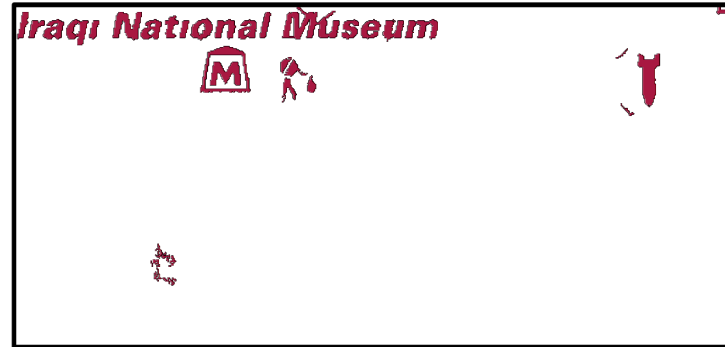
Original map

National

Antiqui

ALHI

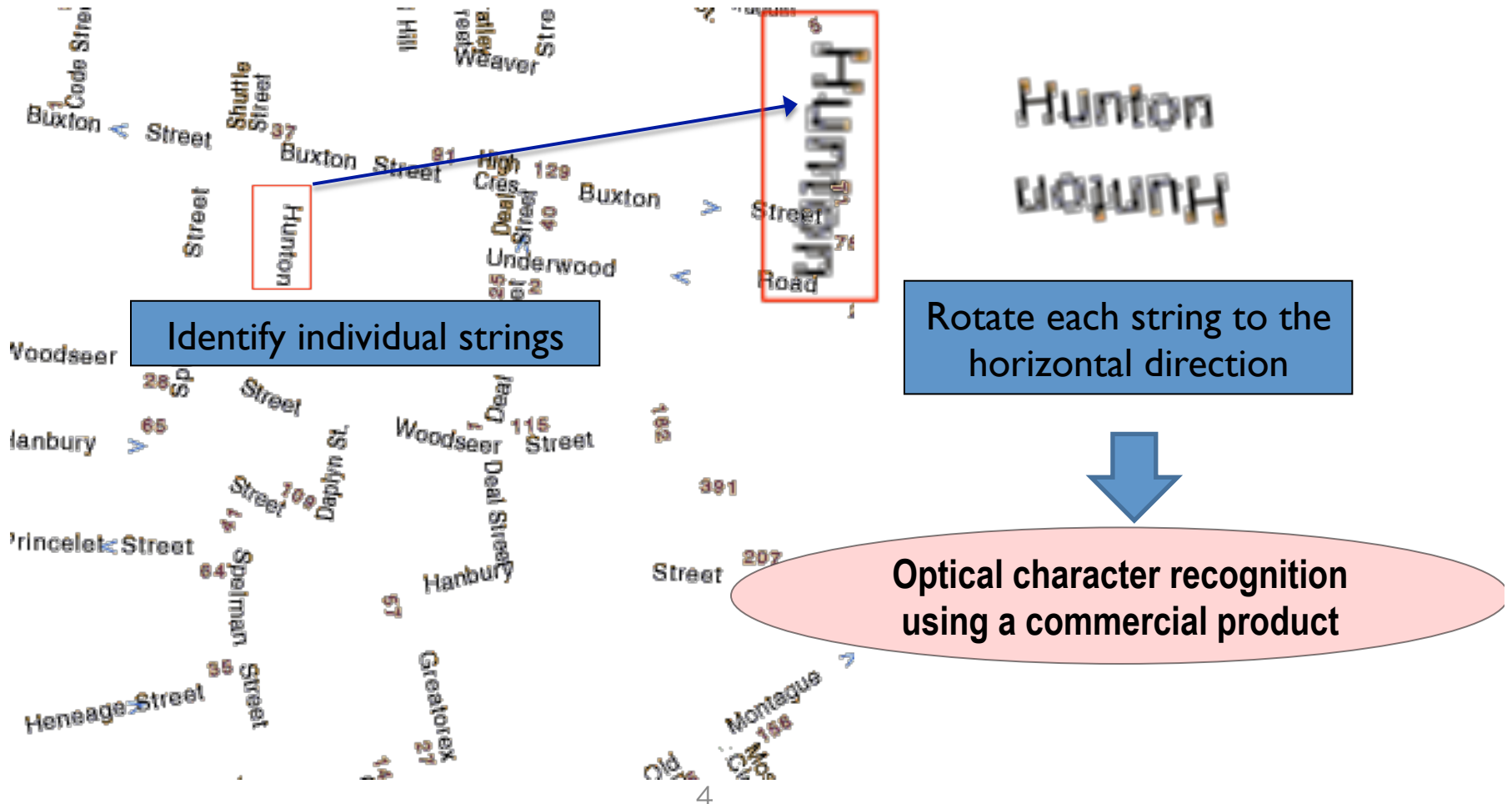
User Labels



Extracted text layers

Text Recognition from the Identified Pixels

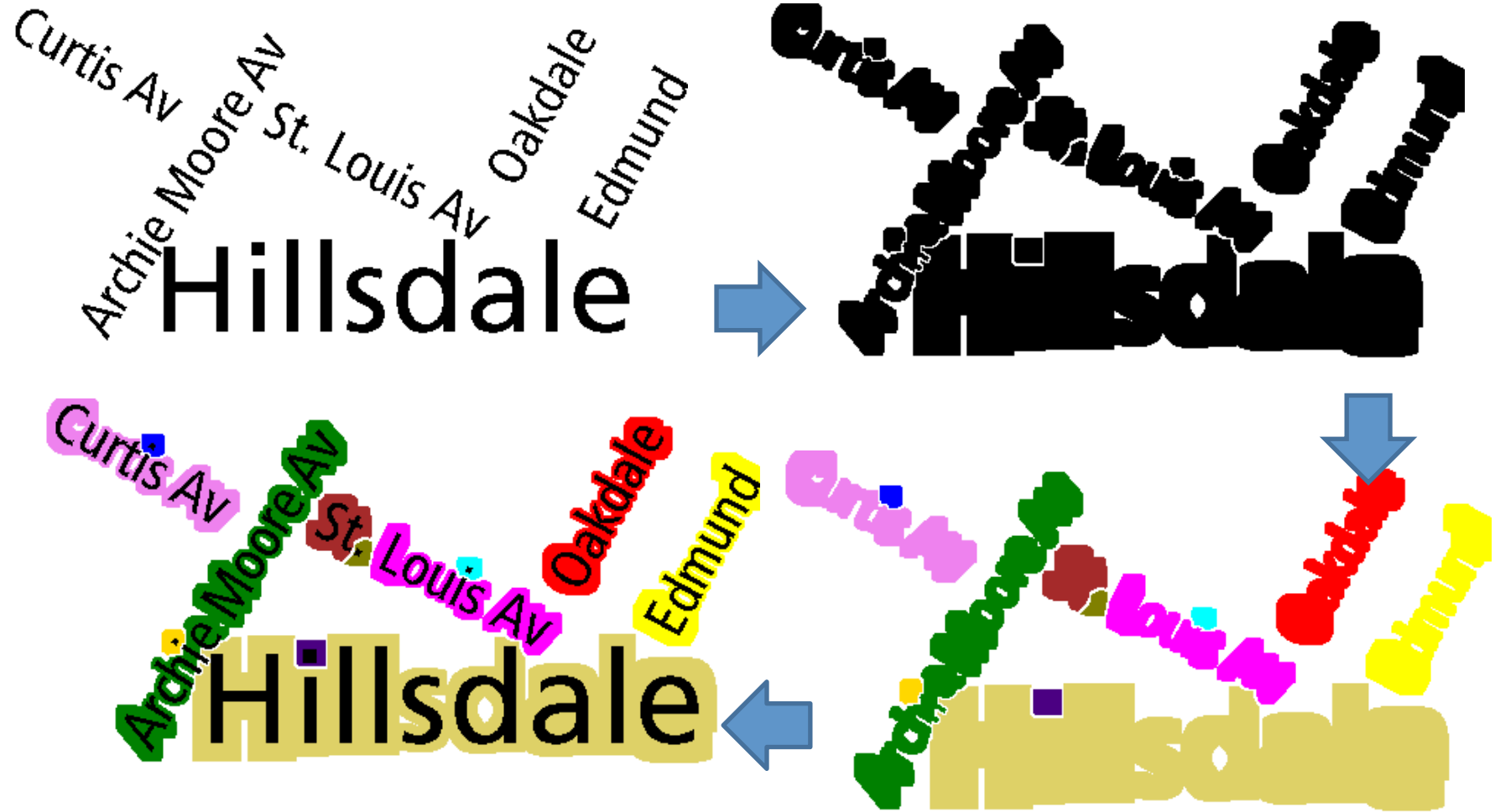
- Multi-oriented text labels
- Characters can have various sizes



Identify Individual Strings

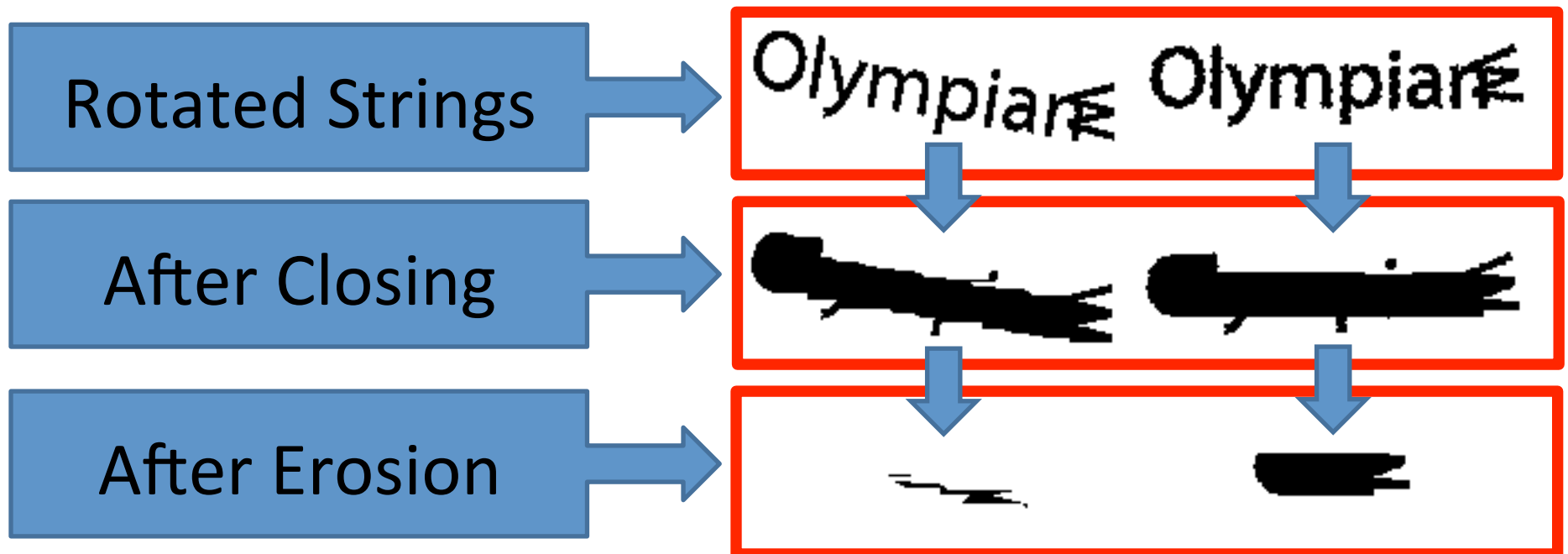
- Conditional Dilation Algorithm:
 - Expand the foreground area of the connected components (i.e., characters) when certain conditions meet
 - To determine the connectivity between the characters
- **Conditions:**
 - A character can only connect to **at most two other characters**
 - Two characters can be connected only if they **have a similar size**
 - A character can only connect to characters **in a local area**
 - Two strings can only be connected if they **have a similar orientation**

Conditional Dilation Results



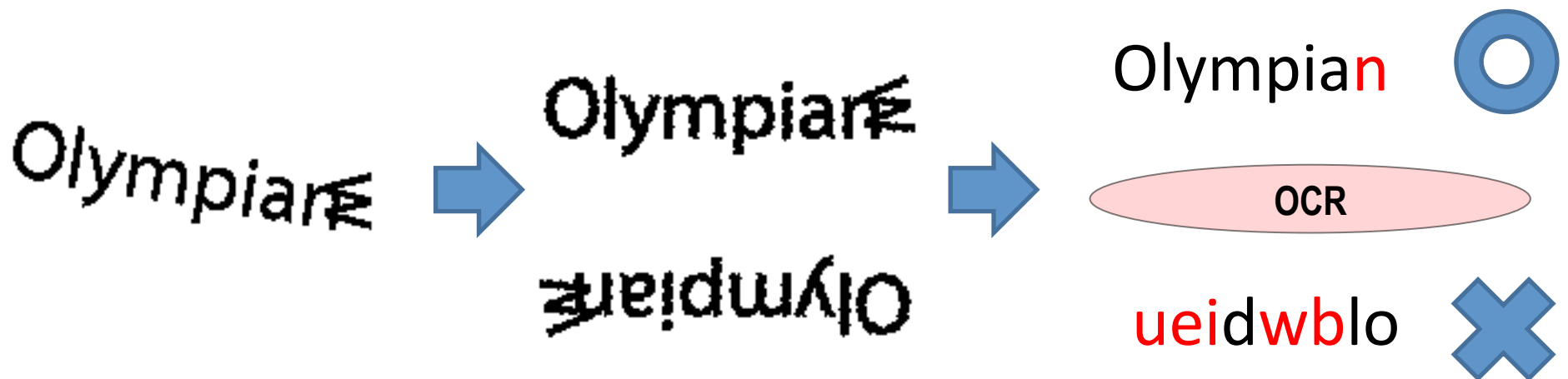
Detect String Orientation

- Rotate a string from 0° to 180°
- Apply Run Length Smoothing algorithm



Recognize Characters in the Horizontal Text Strings

- Feed the horizontal text strings to a commercial OCR product
- Use the OCR returned confidence to determine the correctly oriented horizontal string
 - Number of **suspicious characters**
 - Number of recognized characters



Experiments

- Tested on 15 maps from 10 sources
- Tested the 15 test maps using an OCR product called ABBYY FineReader alone for comparison



Examples of Test Maps

Experiments (Cont'd)

- Strabo extracted 22 text layers using 74 user labels (avg. 3.36)
- Strabo extracted 6,708 characters and 1,383 words
- ABBYY FineReader extracted 2,956 characters and 655 words

	Char. P.	Char. R.	Char. F.	Word P.	Word R.	Word F.
Avg. (Strabo)	92.77%	87.99%	90.32%	82.07%	77.58%	79.76%
Avg. (ABBYY)	71.99%	30.09%	42.44%	46.11%	20.64%	28.52%