

Automatic Georeferencing of Map Images Using Unsupervised Learning and Graph Analysis

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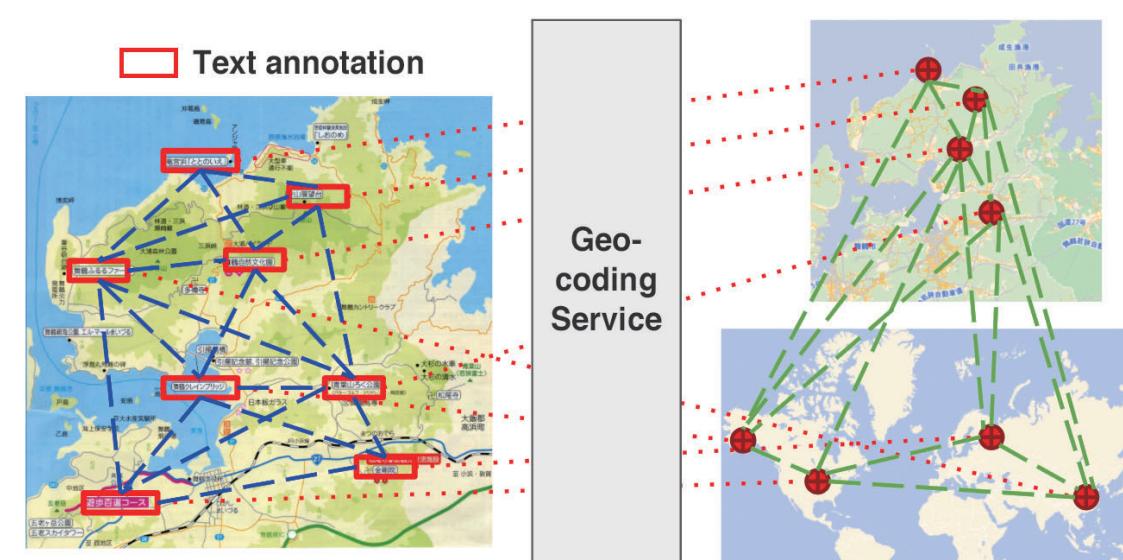
INTRO

- 1 Georeferencing means associating each pixel of a raster image to its geographical coordinates.
- 2 Manual georeferencing is a difficult and time consuming task.
- 3 There has been little discussion about automatic georeferencing of heterogeneous illustrated or historical map images.

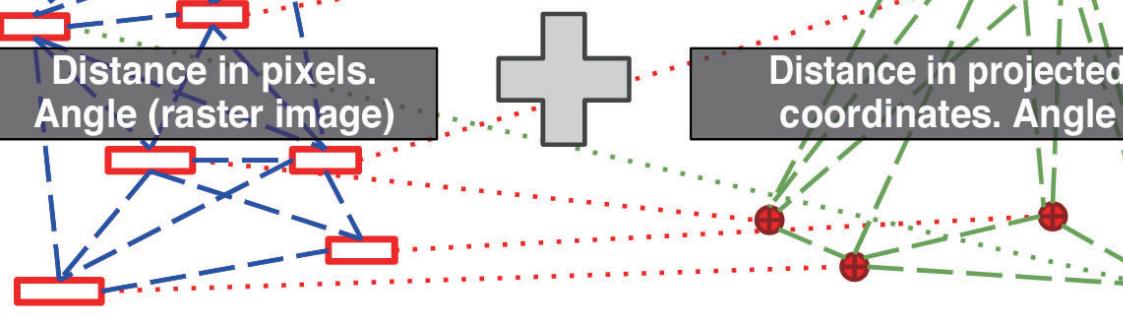
In this work we propose a method to perform this task

METHOD

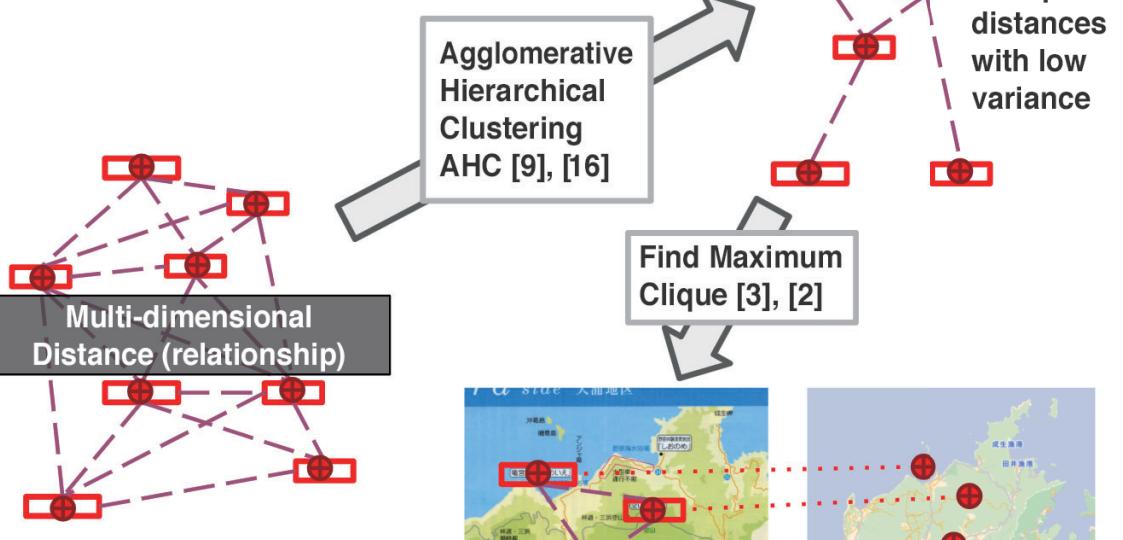
- 1 Create a series of candidate Ground Control Points (GCP) by joining OCR and Geocoding results.



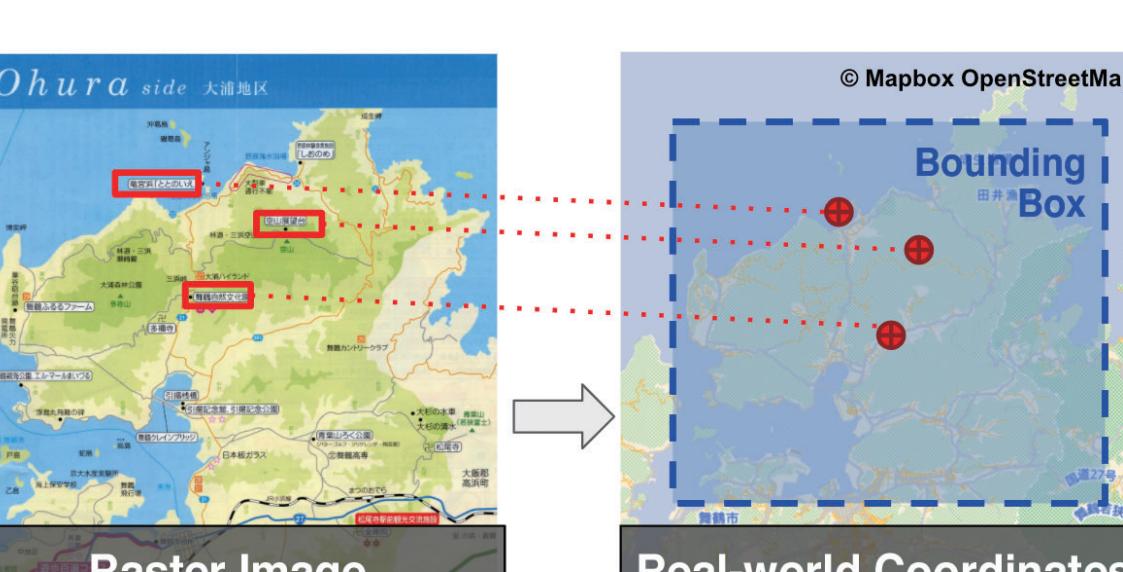
- 2 Calculate multidimensional distances between each pair of candidate GCP.



- 3 Use Agglomerative Clustering and graph analysis to find cliques of low variance.



- 4 Use the largest clique with lowest variance to calculate the georeference information.



RESULTS

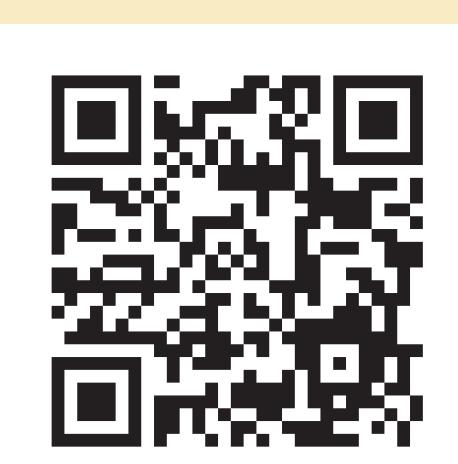
- 1 The method can automatically calculate the real area of different kinds of maps
- 2 Even for small cliques of GCP, the precision is greater than 80%. For larger cliques it can reach 98%.

At Stroly
we created a method to
automatically detect
the geographical area depicted
by map images

- Using Agglomerative Hierarchical Clustering (AHC) and graph analysis.
- No matter the style, the language, or the scale.
- No need for hints or metadata, the only input is the image.



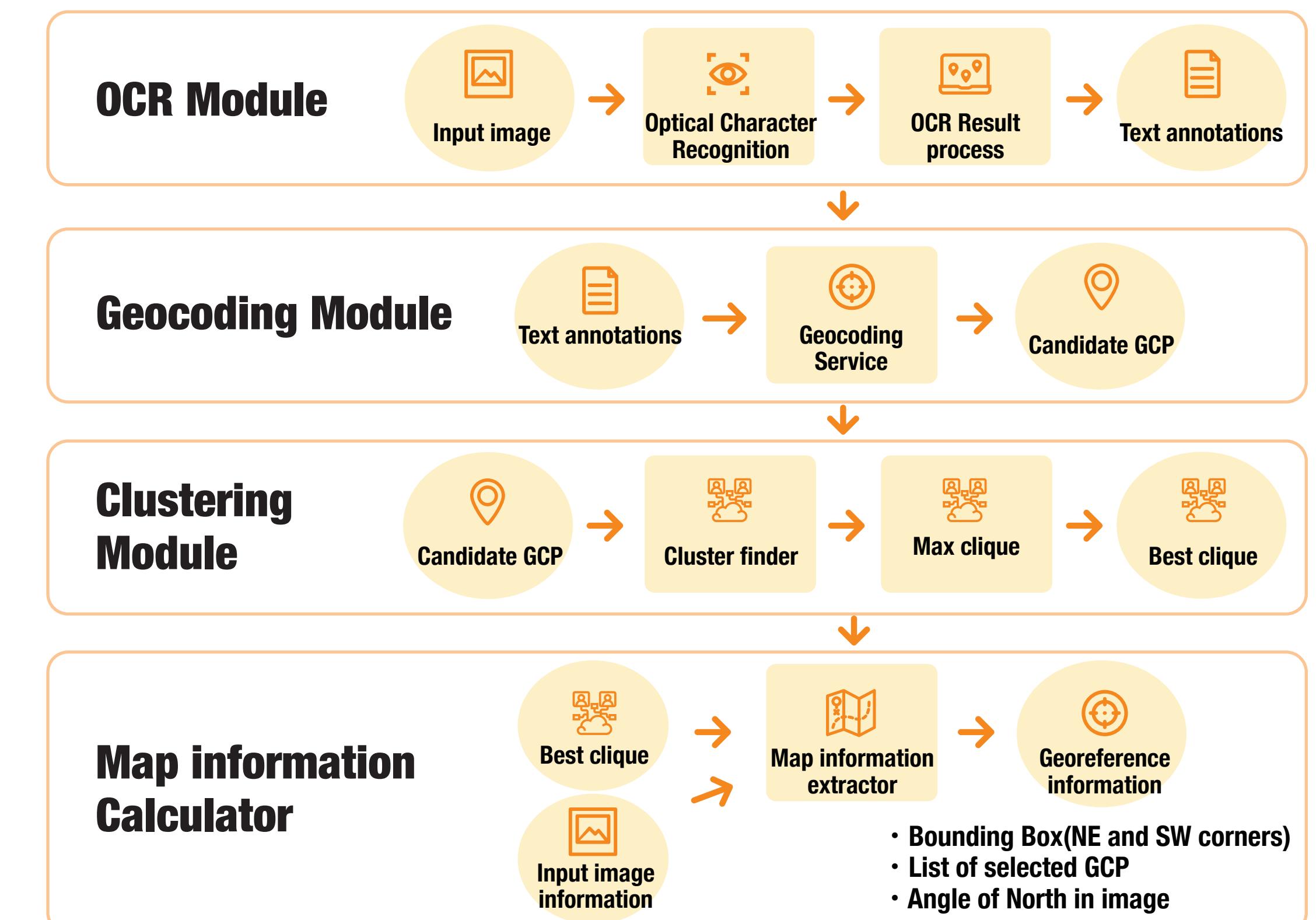
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Take a picture to watch videos of the system in action
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Overview of the method



Results changing the minimum accepted size of the GCP clique

(359 MAPS)

	Minimum Size of the Selected Clique			
	3 GCP	4 GCP	5 GCP	6 GCP
Georeference Information Found	319	265	226	205
Correct Information ($\text{IoU} \geq 0.20$)	259	242	219	200
Incorrect Information ($\text{IoU} < 0.20$)	60	23	7	5
Precision	81.19 %	91.32 %	96.90 %	97.56 %
Recall	71.15 %	67.41 %	61 %	55.71 %

*GCP: Ground Control Points

Further discussion

1. Technical limitations
 2. Map limitations
 3. Future work
- OCR and Geocoding quality
 - Maps without text
 - Unusual projections, perspective
 - Multiple map layers
 - Increase precision and recall
 - Detect projection used
 - Open source the code used

More examples of illustrated maps

