

第30回GIS研究会

修士論文題目

GISにおける定性的空間推論 の適用に関する研究

Studies on Applying Qualitative Spatial Reasoning for GIS

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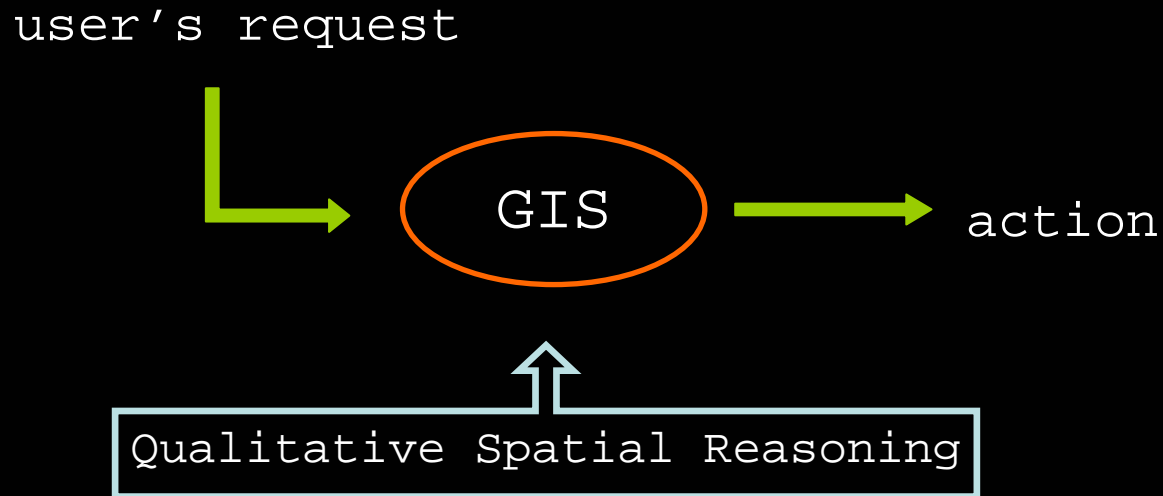
東京学芸大学 大学院 教育学研究科 総合教育開発課程 情報教育コース

2008.1.24

1/12

1.background

- decision making process

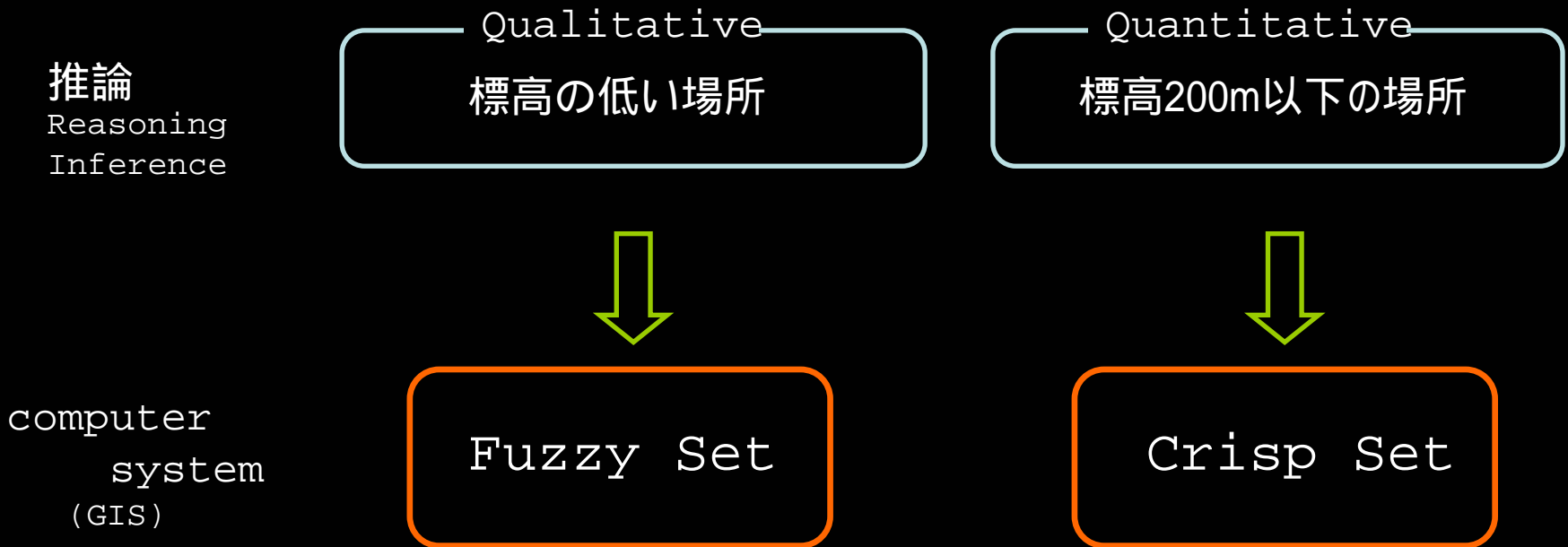


- user's request

user's request

定性推論 (Qualitative reasoning) (定量推論)

- emphasize a human perception than numeric.



objective

- applying qualitative spatial reasoning for GIS
 - Application example is very few.
- improve problem of past studies

2. Fuzzy Sets Theory

conventional set (crisp set)

- $A = \{a, b, c, d\}$
- $A = \{x \mid 0 < x < 1\}$

• defined by element

Fuzzy Set

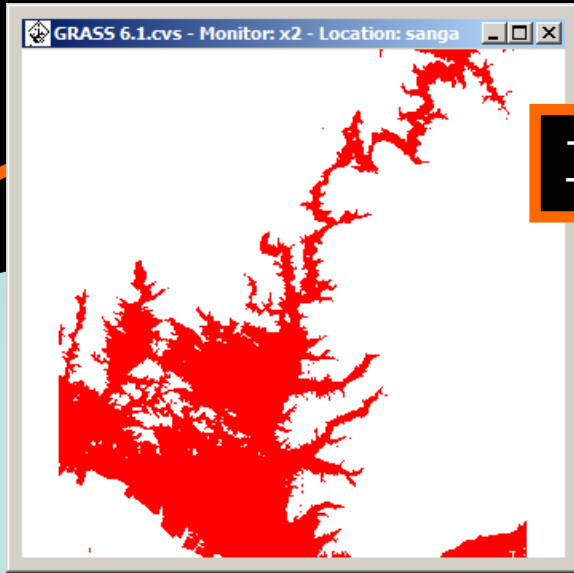
def
 $A \Rightarrow \mu_A : x \mapsto [0,1]$

def
 $A \Rightarrow A = \{0.4/a + 0.6/b + 0.1/c + 0.8/d\}$

• defined by
membership function

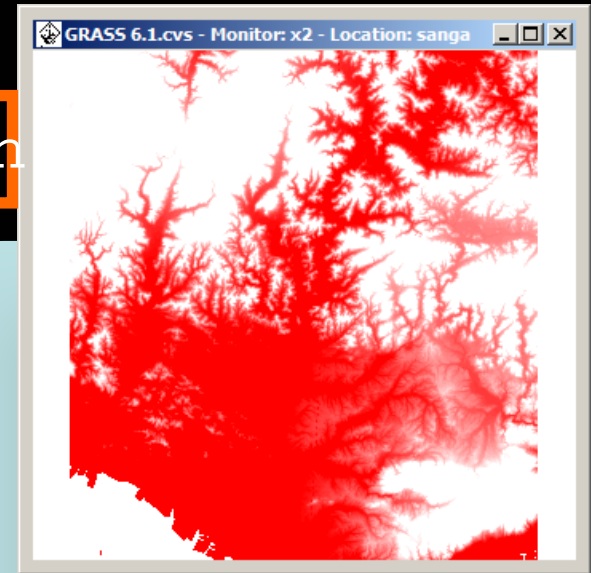
$$\exists! \alpha \text{ s.t. } \{ \forall x \mid \mu_A(x) = \alpha \in [0,1], x \in X \}$$

Fuzzy Set and GIS

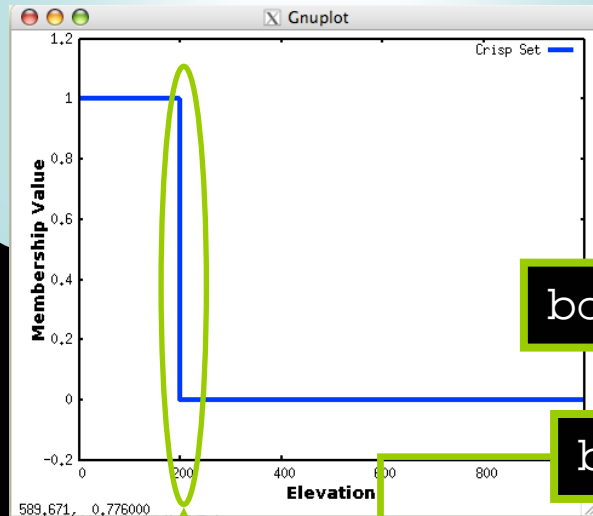


low elevation

Crisp set

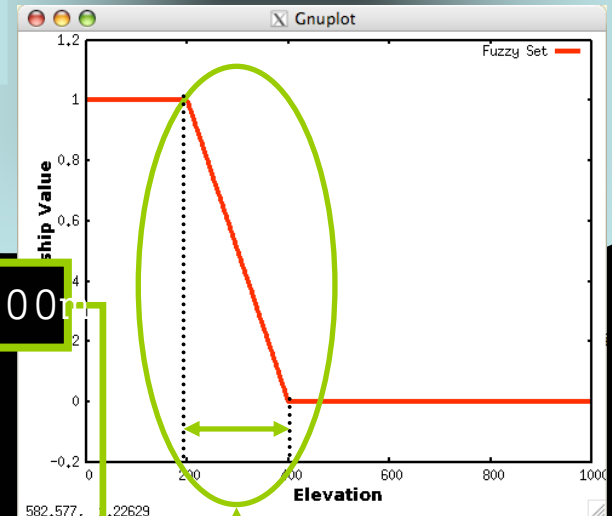


Fuzzy set

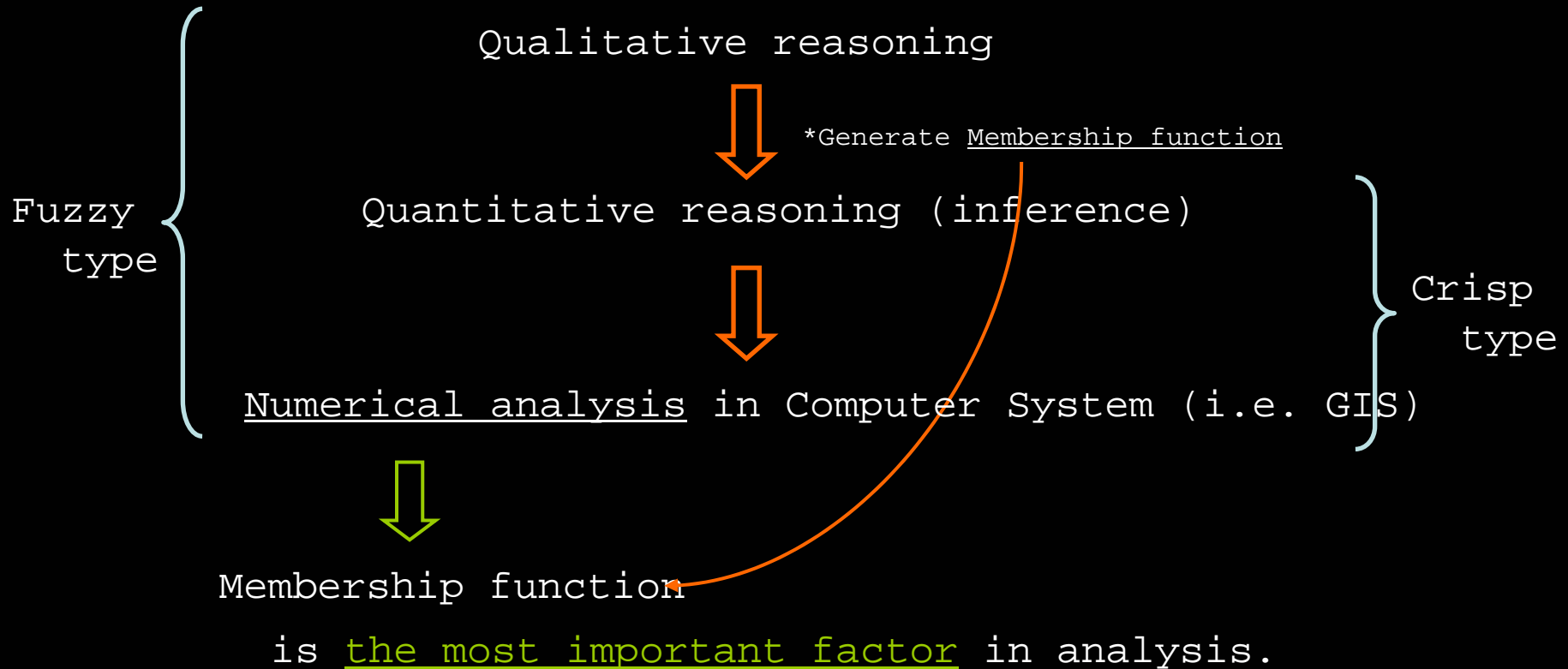


boundary is 200 ~ 300

boundary is 200m

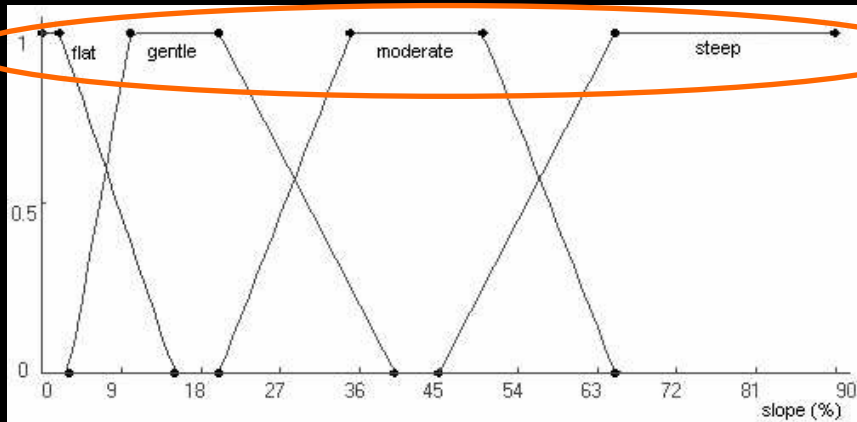


Qualitative Reasoning Process



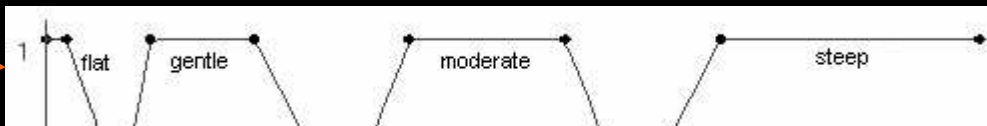
3.problem of past studies

- List of membership function



Tahsin A. Y., and Zuhail A., 2004, The Enhancement of ArcGIS with Fuzzy Set Theory, *ESRI International User Conference*

- Linguistic term



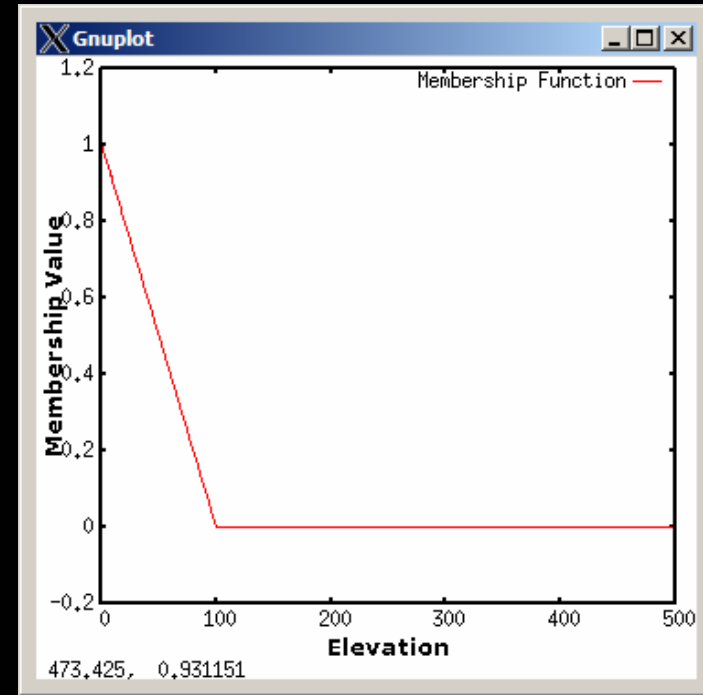
• Flexible
• Scale

- Relate one of the list of membership function

4.algorithm

1. input raster map and reasoning factor (low or high)
2. calculate the statistics of the map
quartile
3. generate membership function
4. check output image or parameter
5. adjust membership function
select more robust or soft criteria

measure of fuzziness



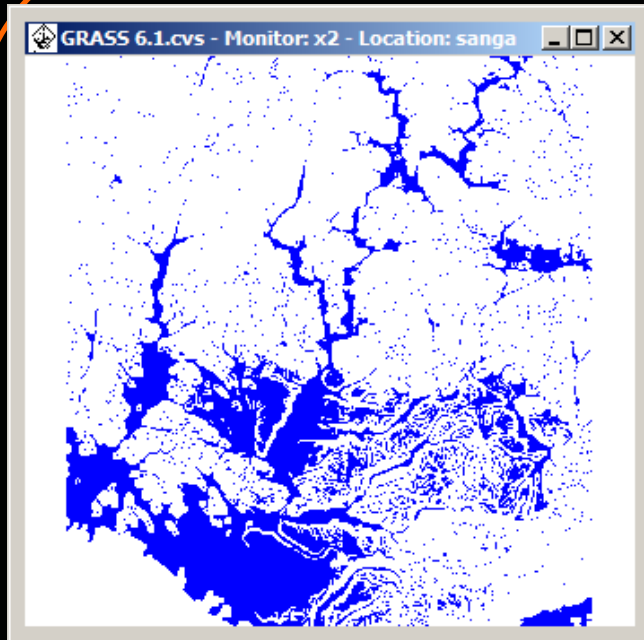
- quartiles and 90percentile
- mean

Measure of fuzziness

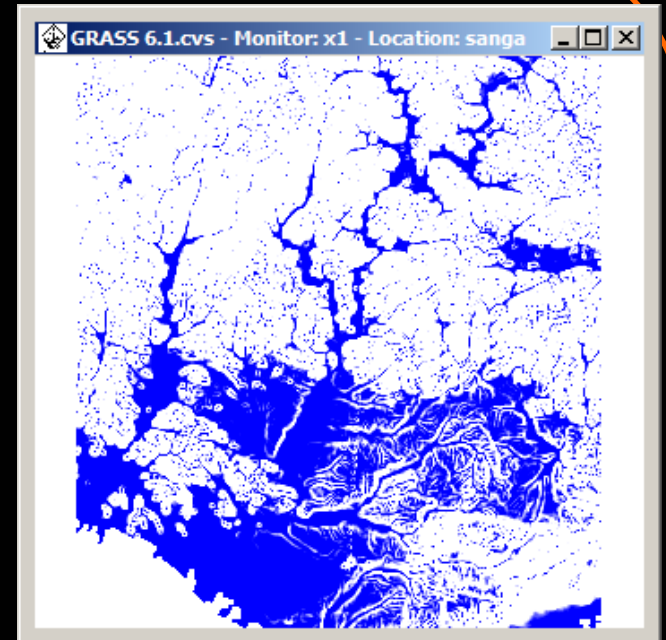
boundary is 2°

slope map

boundary is $2^\circ \sim 4^\circ$



crisp set



fuzzy set

0

measure

0.089317

of

fuzziness $\in [0,1]$

5.conclusion

- users are **easy** to use this

- interface



input map, reasoning factor
output image, adjust factor

- without fuzzy set theory



without manipulating membership function

- measure of fuzziness

- **Fuzzy entropy**



effective for adjustment process

- scale



Using quartile

- flexible way



more flexible than approach having input form.

ご清聴ありがとうございました。

thank you for your attention.