Using NPR-Techniques for the Visualization of Uncertainty

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Motivation:

- Usually the data to be visualized is associated with uncertainties (e.g., during measuring, aggregation, sampling...)
- Sharing the classical visual attributes (Bertin / Mackinlay) for data and uncertainty visualization is often not intuitive and has to be explained explicitly
- A somehow common approach is to use fuzzy or blurred representations of uncertain data, e.g. using the extended set of visual attributes by MacEachren
- NPR-techniques generate fuzzy images as a matter of principle

Idea: Using NPR-techniques in information visualization to generate fuzzy representations for the visualization of uncertainties!

Uncertainties visualized simultaneously with corresponding data:

Exemplary Results:

Watercolor simulation
Example:
- Uncertainties from aggregating subregions
Mapping:
- Data values mapped onto color
- Missing data mapped onto absorbability
- Standard deviation mapped onto capacity
Results:
- Uncertainties generate fuzzy regions
- High and low values are extractable: data (+), stddev (*), missing (#)
- Parameters slightly influence each other

Simplified Strokes
Example:
- Uncertainties from aggregating time spans
Mapping:
- Data like in standard parallel coordinates
- Missing data mapped onto dashing gaus
- Standard deviation mapped onto amplitude
Results:
- Data values still readable
- Both uncertainties extractable per axis
- Wiggly lines generate clutter and thus are used within an uncertainty lens