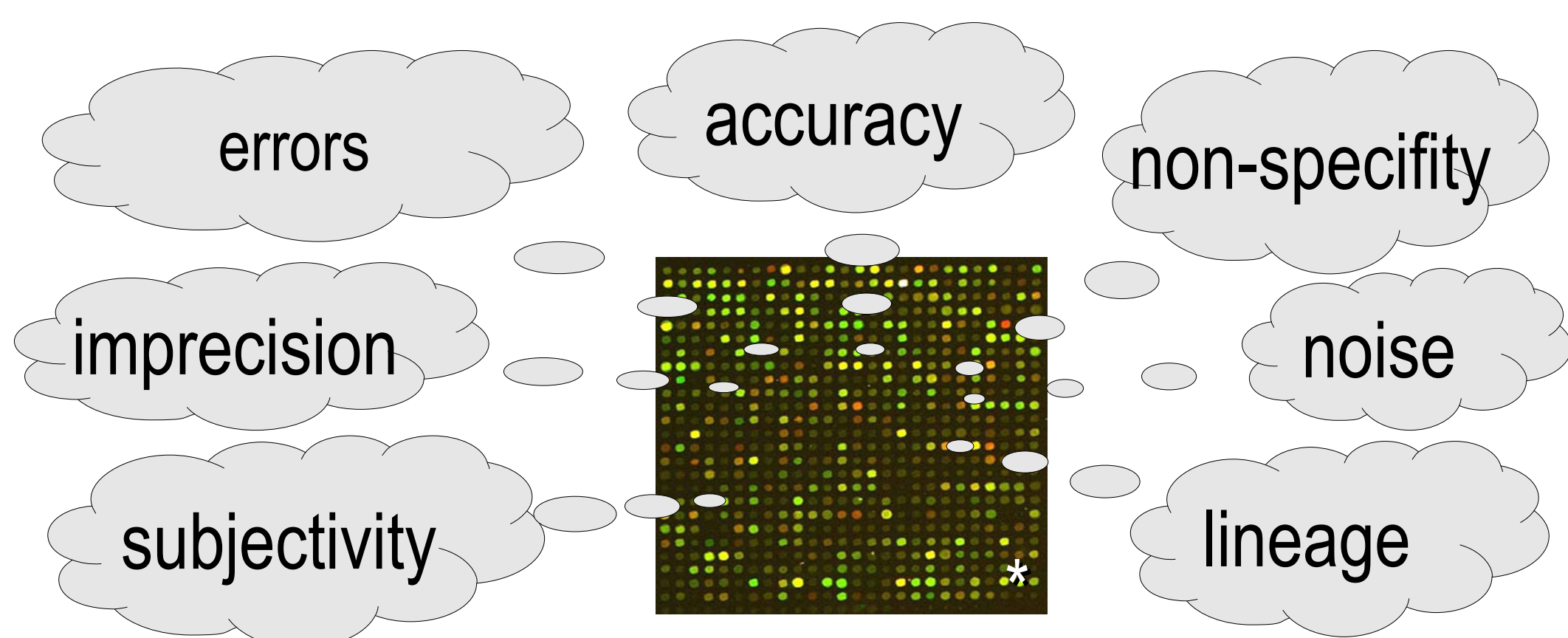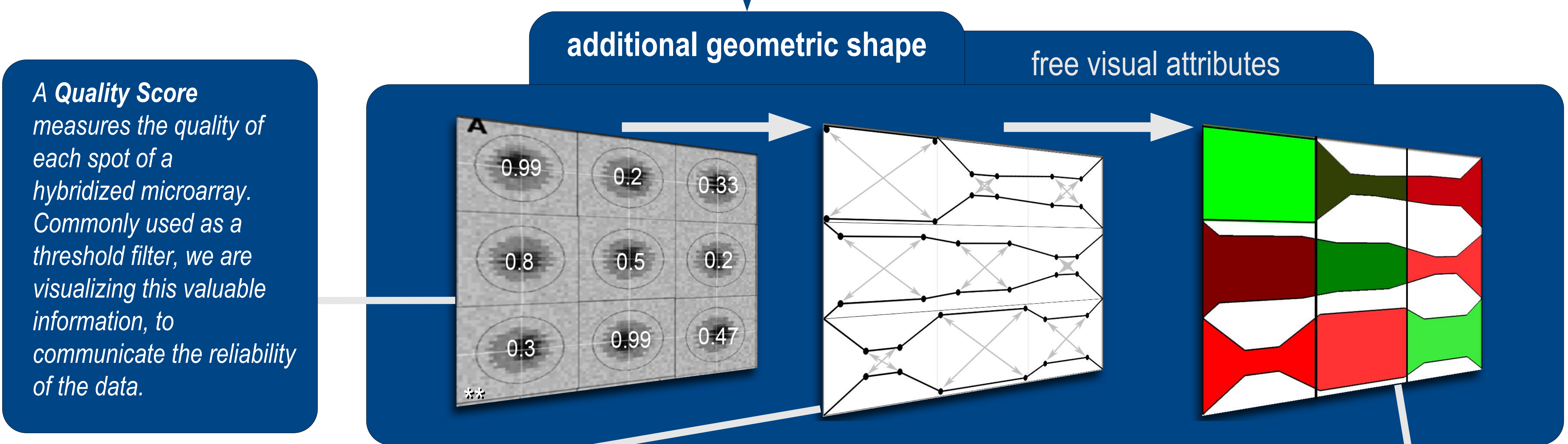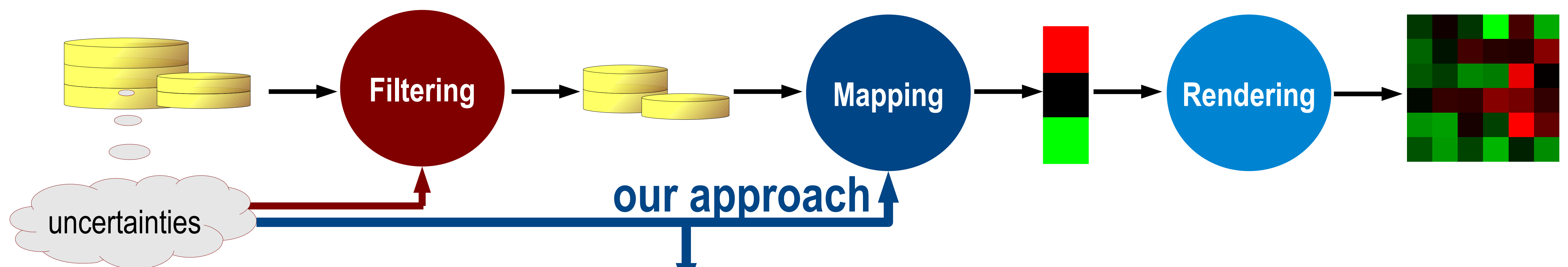# Enriched Heatmaps for Visualizing Uncertainty in Microarray Data

Clemens Holzhüter, Hans-Jörg Schulz, Heidrun Schumann

errors · accuracy · non-specifity · imprecision · noise · subjectivity · lineage
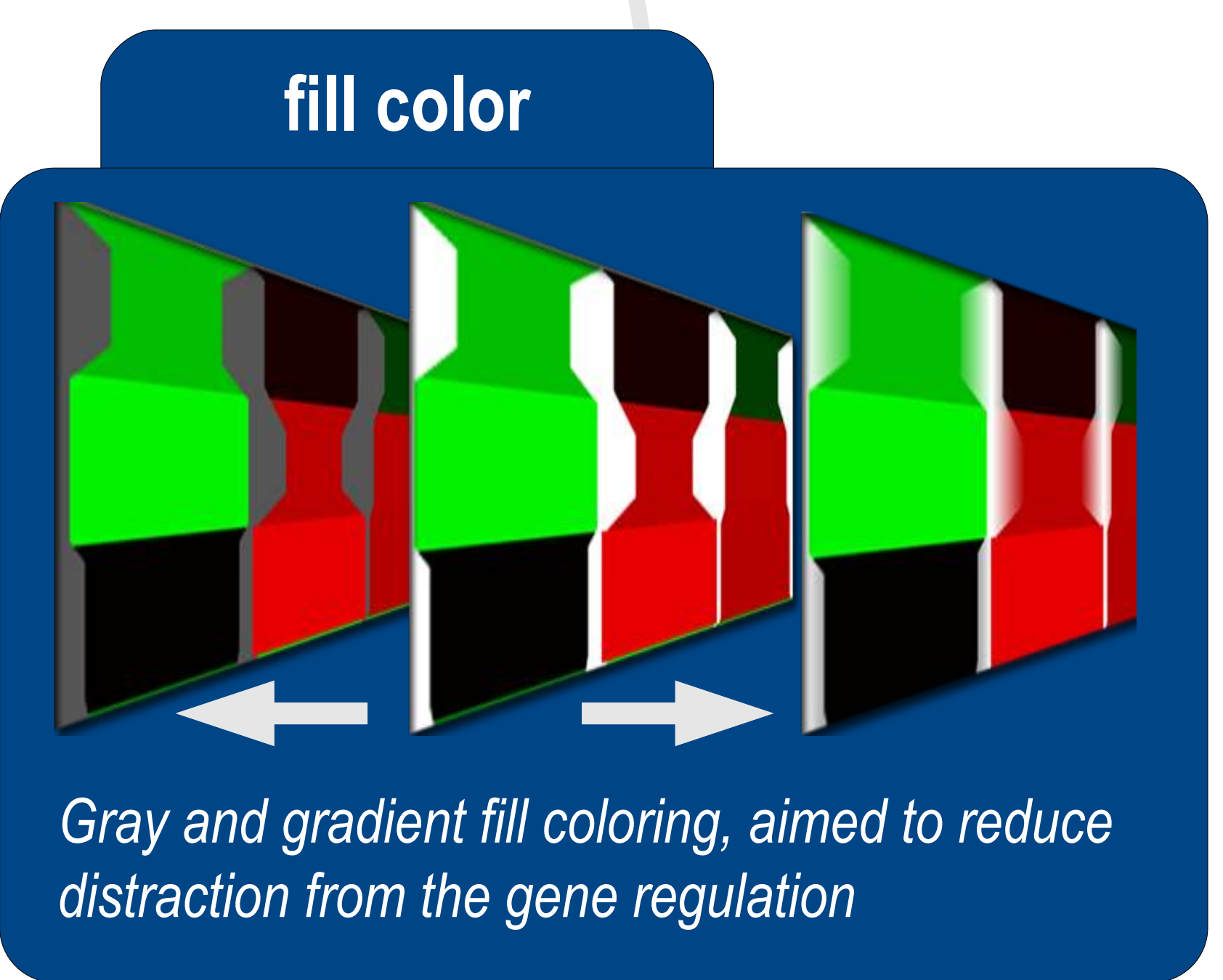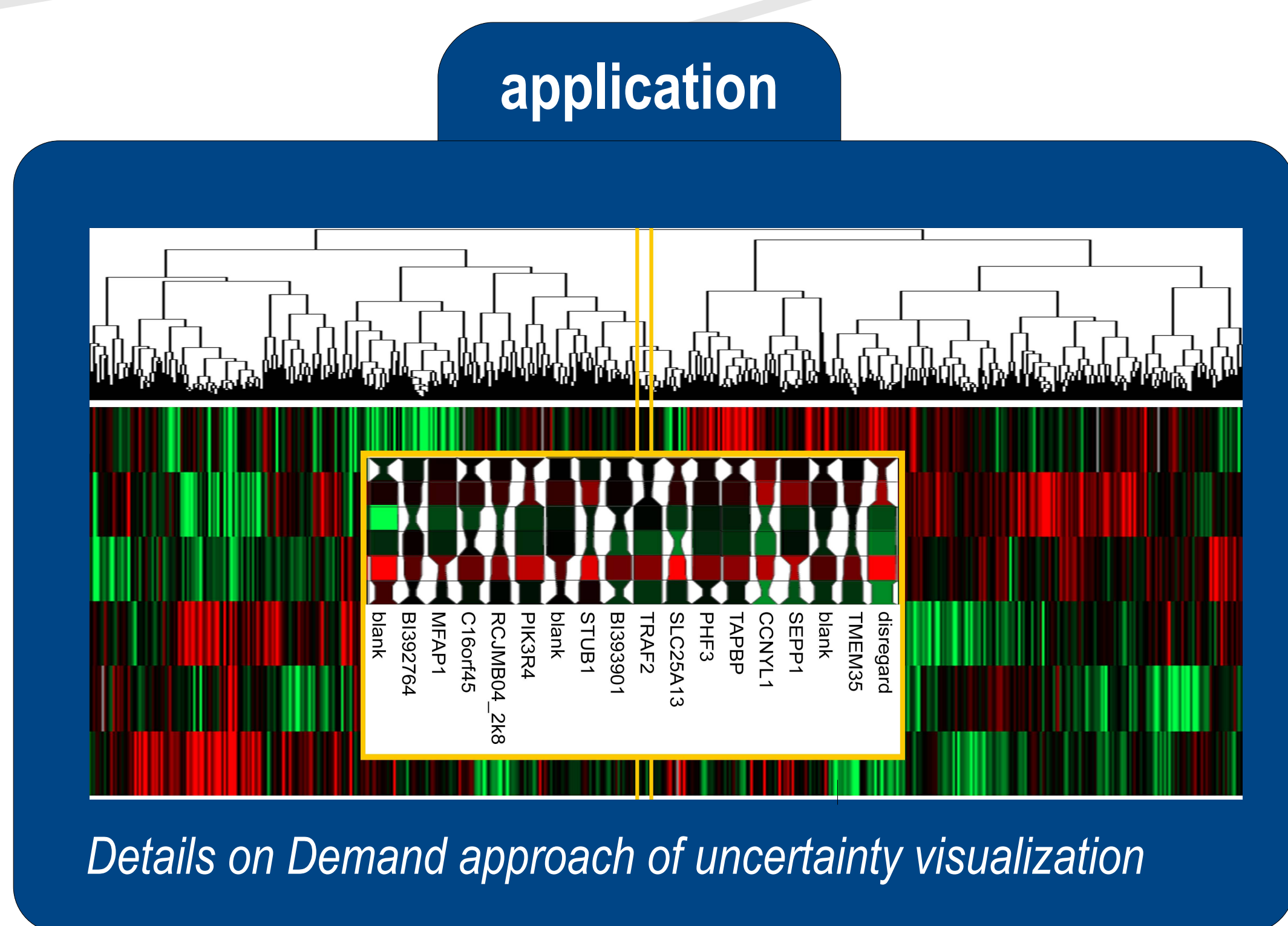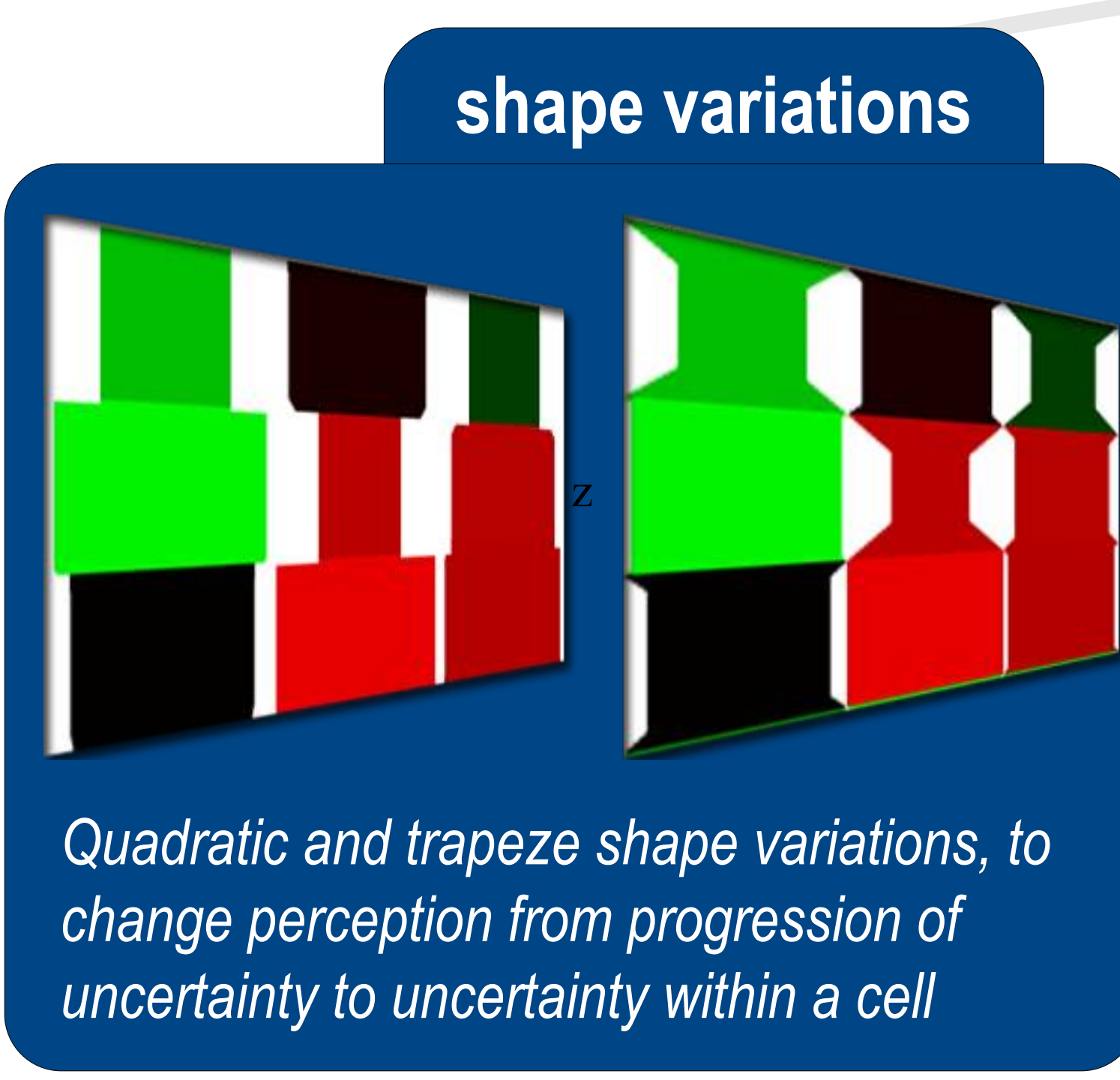
Uncertainty: „Degree to which the lack of knowledge about the amount of error is responsible for hesitancy in accepting results and observations without caution[1]"

classic visualization of microarray data using heatmaps with measurements for uncertainty used for filtering and normalization

Filtering → **Mapping** → **Rendering**

uncertainties

our approach

additional geometric shape

free visual attributes

A **Quality Score** measures the quality of each spot of a hybridized microarray. Commonly used as a threshold filter, we are visualizing this valuable information, to communicate the reliability of the data.

A 0.99 0.2 0.33 0.8 0.5 0.2 0.3 0.99 0.47

shape variations

Quadratic and trapeze shape variations, to change perception from progression of uncertainty to uncertainty within a cell

application

Details on Demand approach of uncertainty visualization

blank · BI392764 · MFAP1 · C16orf45 · RCJMB04_2k8 · STUB1 · PIK3R4 · blank · TRAF2 · BI393901 · SLC25A13 · PHF3 · TAP8P · SEPP1 · CCNYL1 · blank · TMEM35 · disregard

fill color

Gray and gradient fill coloring, aimed to reduce distraction from the gene regulation

[1] G. J. Hunter and M.F. Goodchild, Managing uncertainty in spatial databases: Putting theory into practice. Journal of Urban and Regional Information Systems Association, 5(2): p. 55-62, 1993

[*] Image from http://www.wormbook.org/chapters/www_germlinegenomics/germlinegenomicsfig1_s.jpg

[**] Image from WANG, X., GHOSH, S., AND GUO, S. 2001. Quantitative quality control in microarray image processing and data acquisition. Nucleic Acids Research 29, 15, e75.

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