EVIVA-ML@ VIS 2019

On the Cost of Interactions in Interactive Visual Machine Learning

Yu Zhang, Bob Coecke, Min Chen
University of Oxford

Interaction: Benefits

- Human knowledge that is not contained in the data, e.g.,
  - annotation or labelling
  - selecting ML frameworks, constructing templates, identifying features, etc.
- Quality assurance of ML models
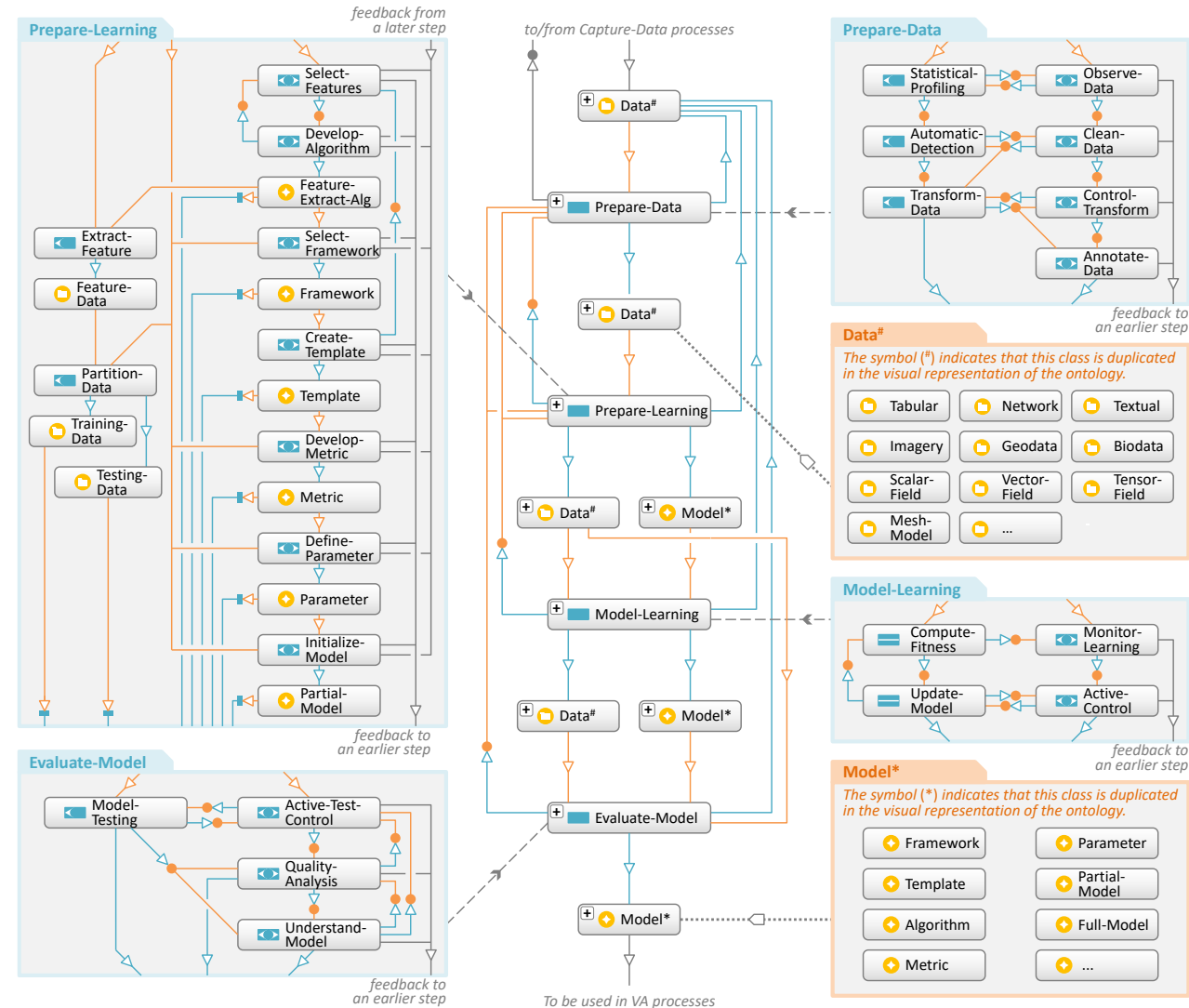 - testing and evaluation
  - error correction

Image from: D. Sacha, et al. "VIS4ML: An ontology for visual analytics assisted machine learning." *IEEE TVCG*, 25(1):385-395, 2019.

Interaction: Cost and Measurements

- **Costs**
  - Usually time-consuming, laborious
  - Often demanding expertise and skills
- **Metrics**
  - number of input actions
  - time used for interactions
  - difficulty level
  - cognitive load
  - cost related to the input modality
  - cost of learning
  - adverse cost of an input error
 - …

Empirical Studies?

Image from: J. Tanner and J. Tanner. *A Big Company's Onboarding User Case Study*, https://medium.com/@jackietanner/a-big-company-s-onboarding-user-case-study-db11a8431fe4
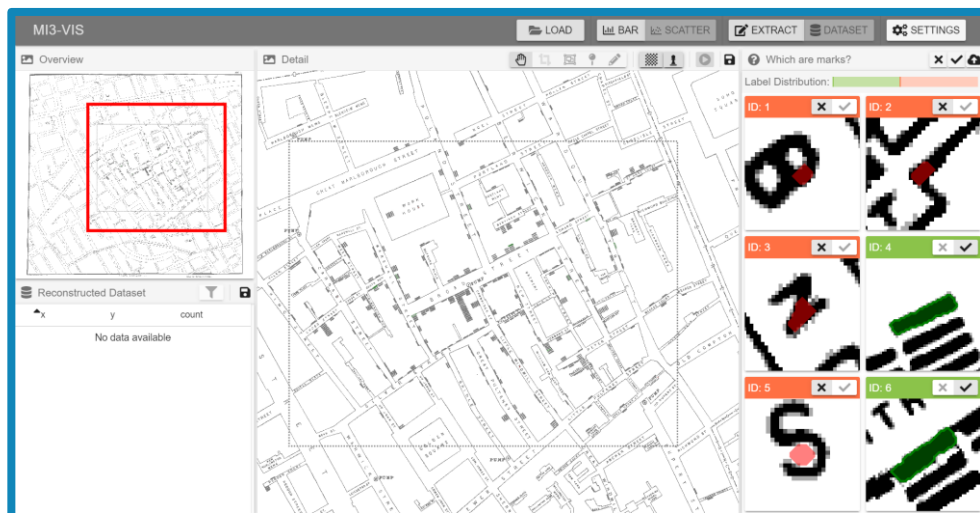
Simulation-based Estimation

EVIVA-ML: Evaluation of Interactive Visual Machine Learning Systems

A Case Study

- Reconstructing 321 data points in John Snow's Cholera Map

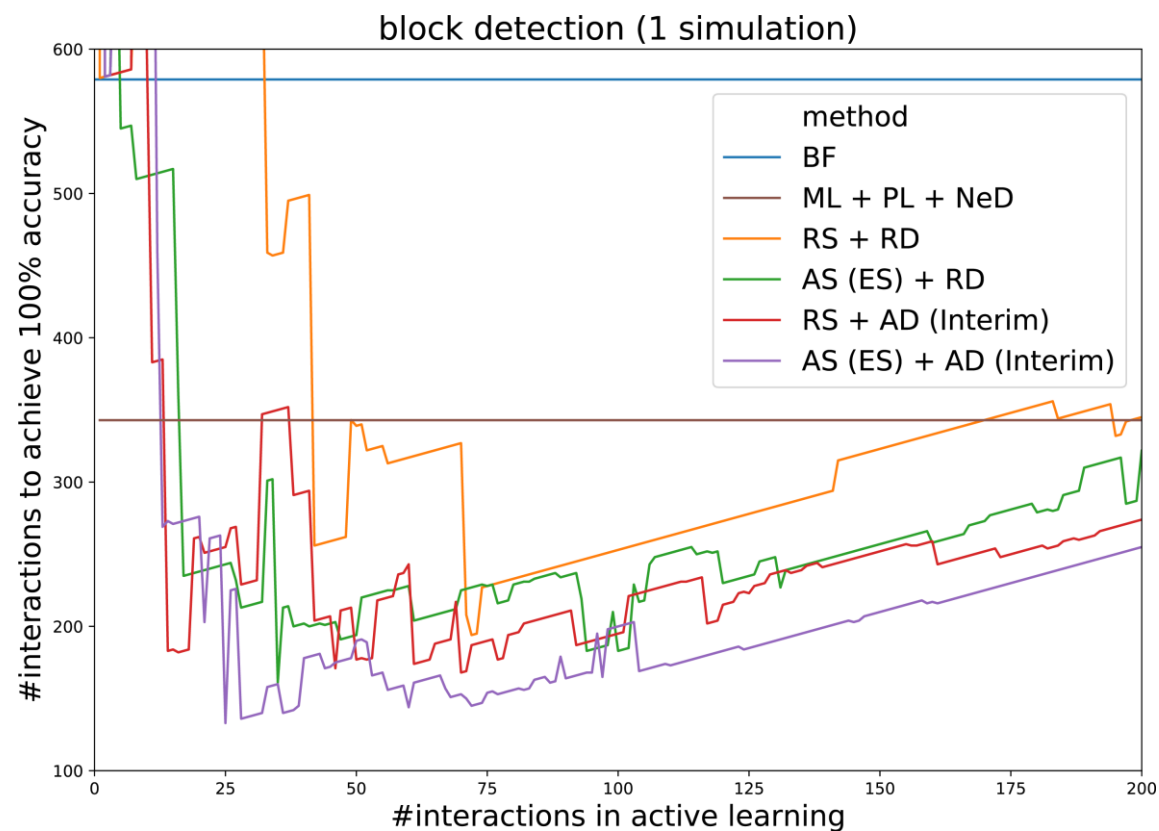- Using pre-ML labelling?

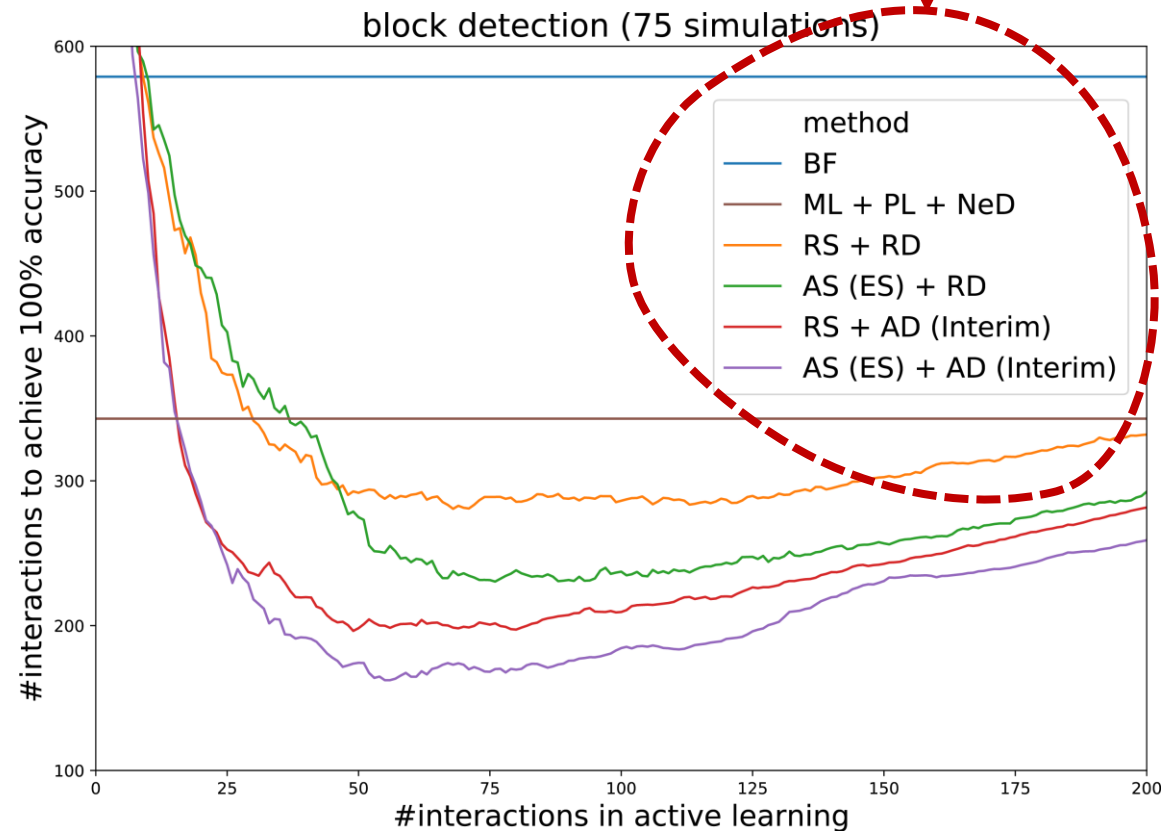- Using Active Learning
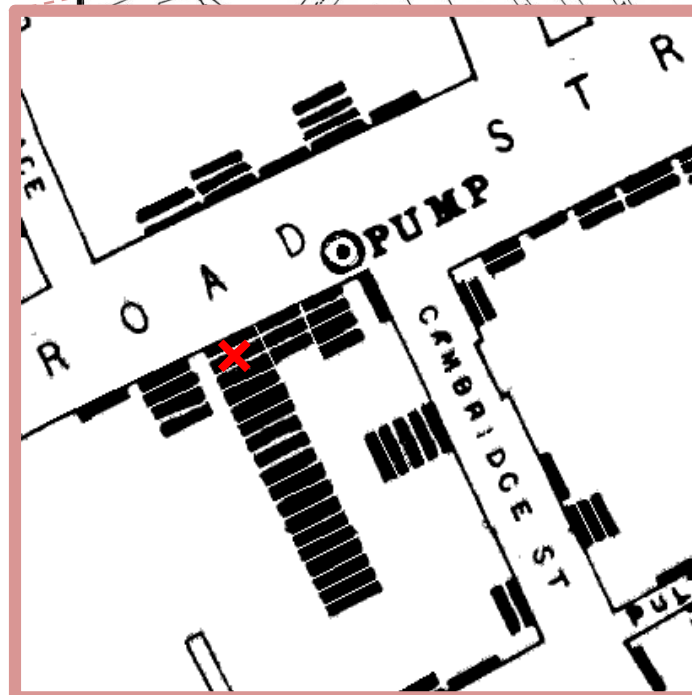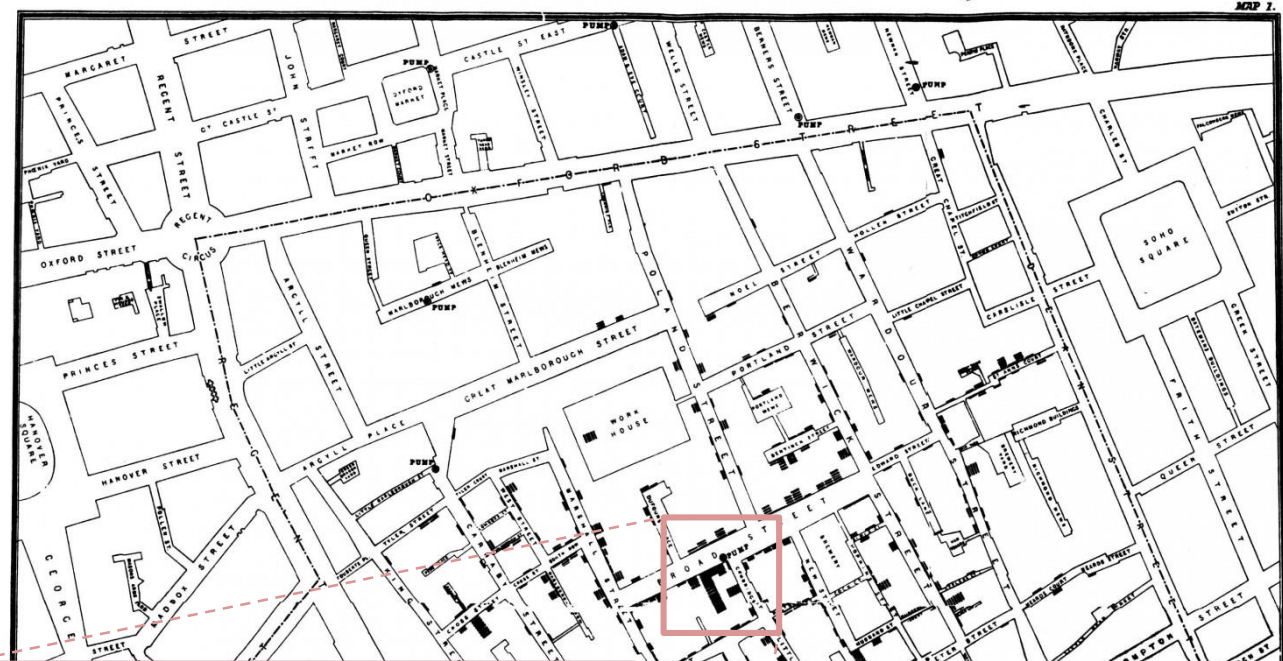
$\times (x, y, \#victims)$

Simulating the Number of Interactions

Different options for algorithm designs and interaction designs

Single-run simulation results

With 75 "repeated measures"