

AdaProp

Adaptive Propositionalisation of Multi-Instance Data
Towards Image Classification

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Image Classification

- Does the Image contain a specific object?

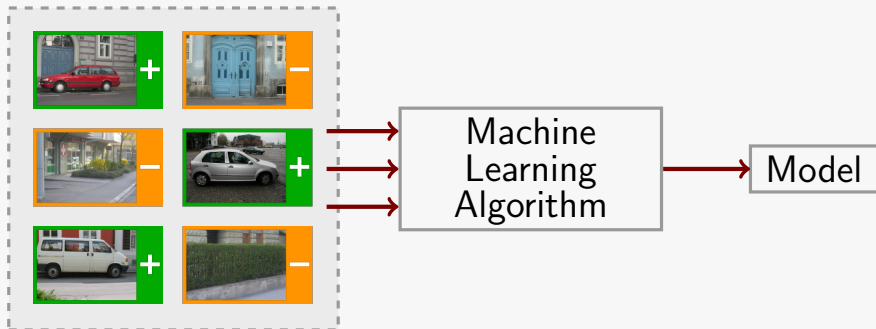


Car (Positive)



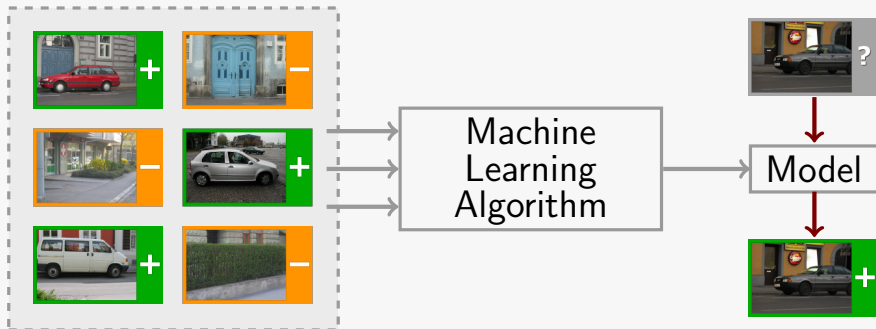
No car (Negative)

Image Classification via Machine Learning



Training Dataset

Image Classification via Machine Learning



Training Dataset

Image Classification: Challenges

- Scale and Orientation



150,000 pixels



3,000 pixels

Image Classification: Challenges

■ Lighting Conditions



Low light



Overexposure

Image Classification: Challenges

- Partial Occlusion



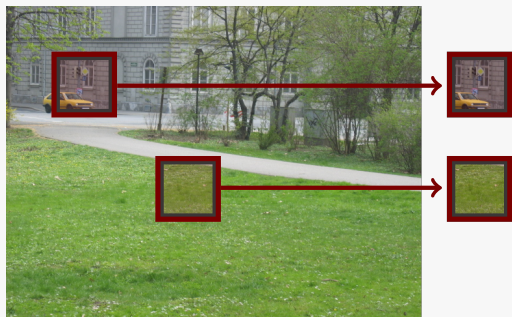
Behind Glass



Obscured by Foreground

Multi-Instance Learning

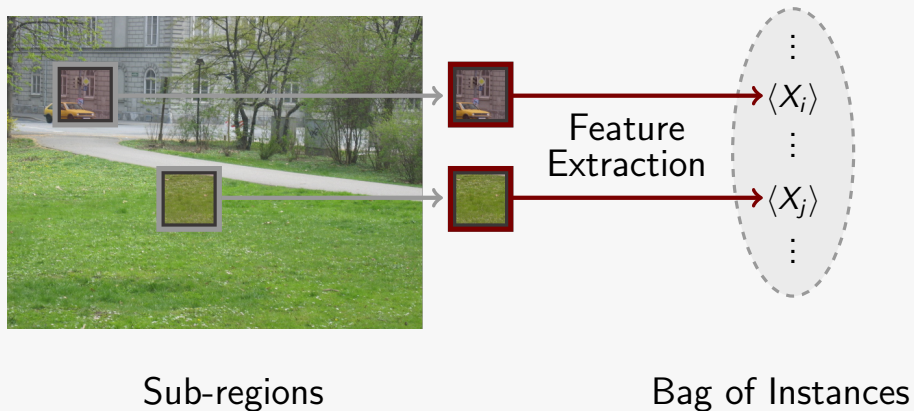
- Natural fit for Image Classification



Sub-regions

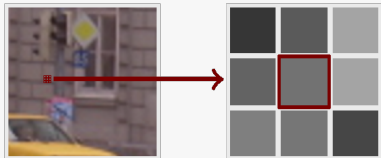
Multi-Instance Learning

- Natural fit for Image Classification

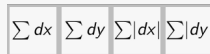
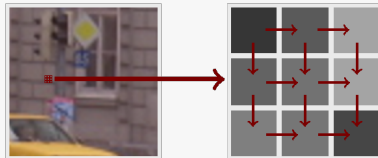


Feature Extraction

- Two well-known approaches



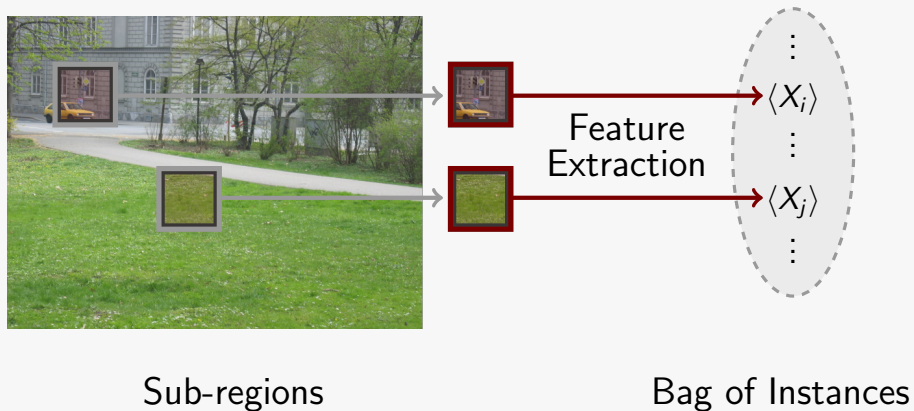
Local Binary Patterns



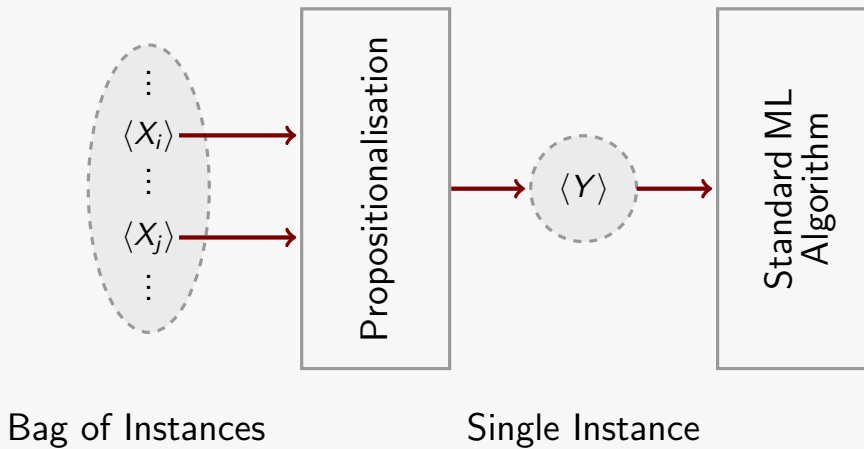
SURF Descriptor

Multi-Instance Learning

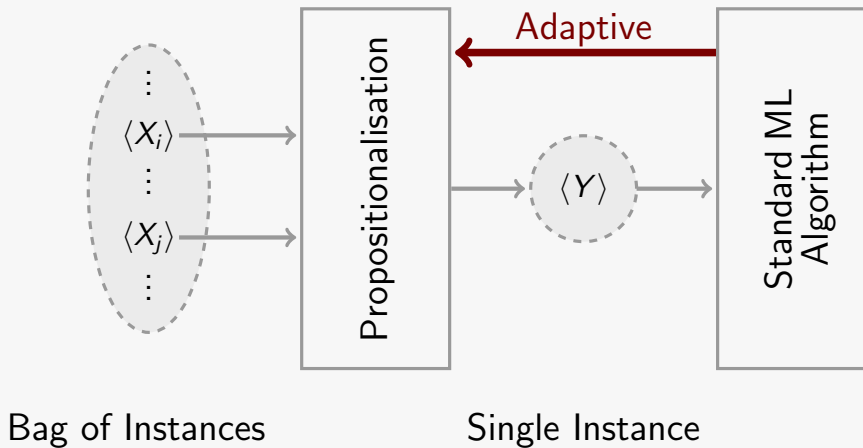
- Natural fit for Image Classification



Propositionalisation



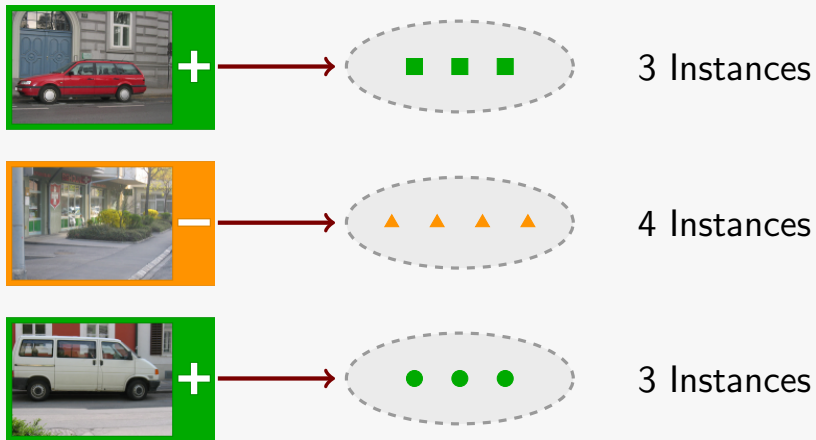
Adaptive Propositionalisation



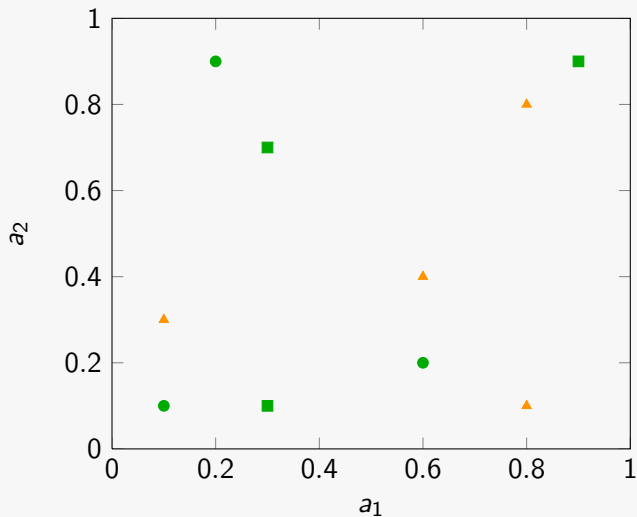
AdaProp: Example Dataset



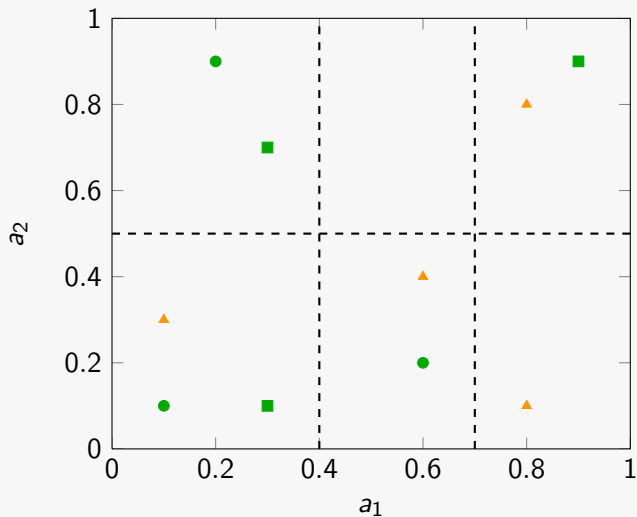
AdaProp: Example Dataset



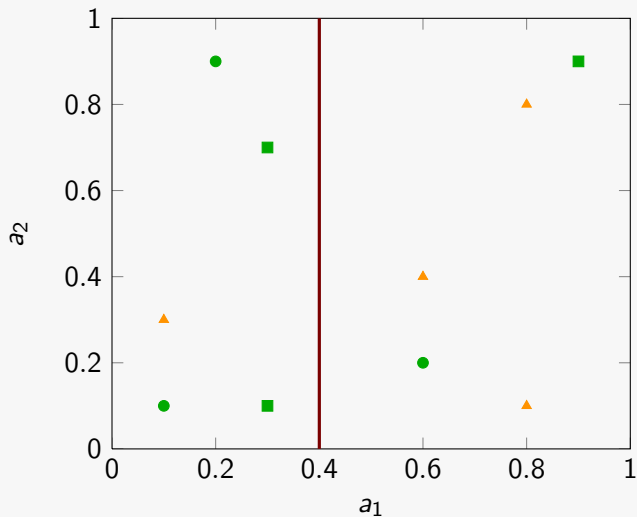
AdaProp: Example Dataset



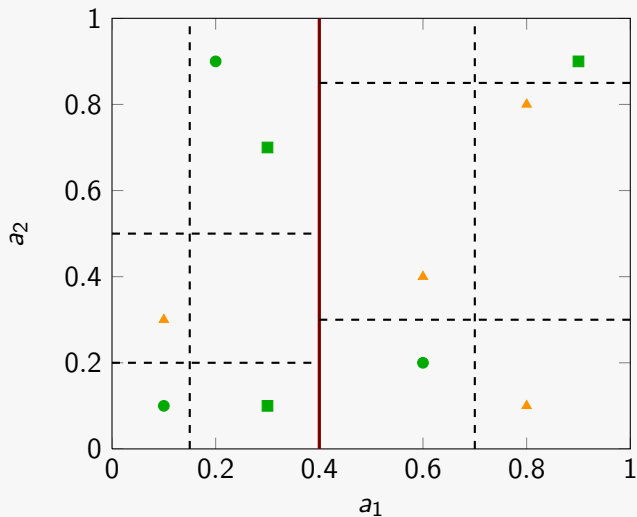
AdaProp: Example Dataset



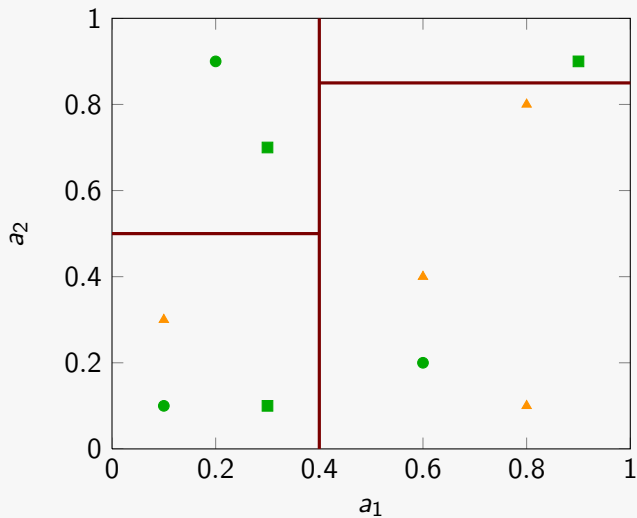
AdaProp: Example Dataset



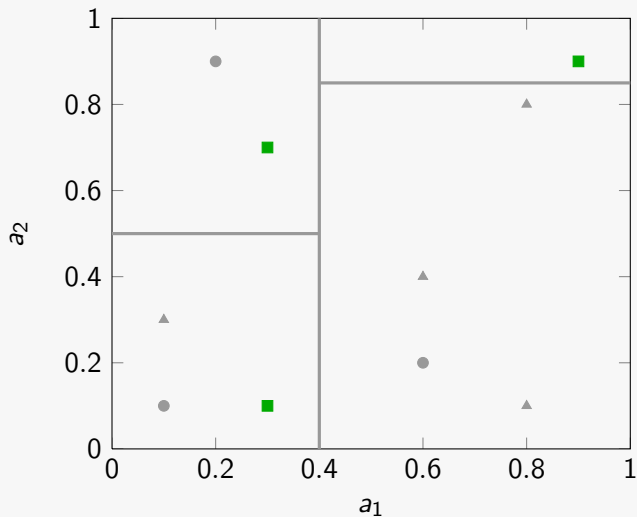
AdaProp: Example Dataset



AdaProp: Example Dataset

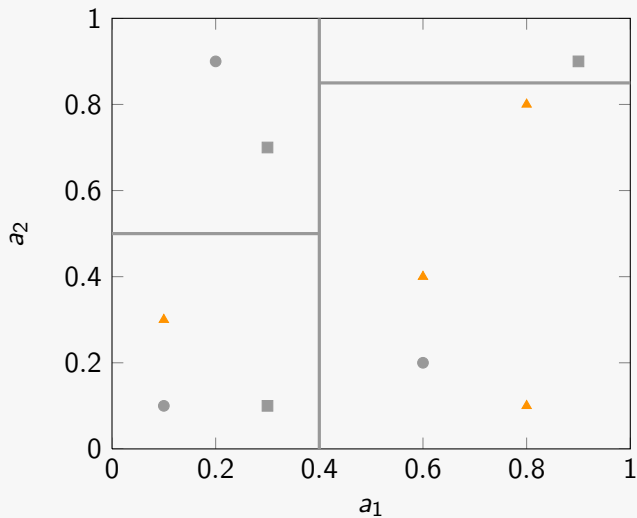


AdaProp: Example Dataset



$$\begin{bmatrix} 1 \\ 1 \\ 1 \\ 0 \end{bmatrix}$$

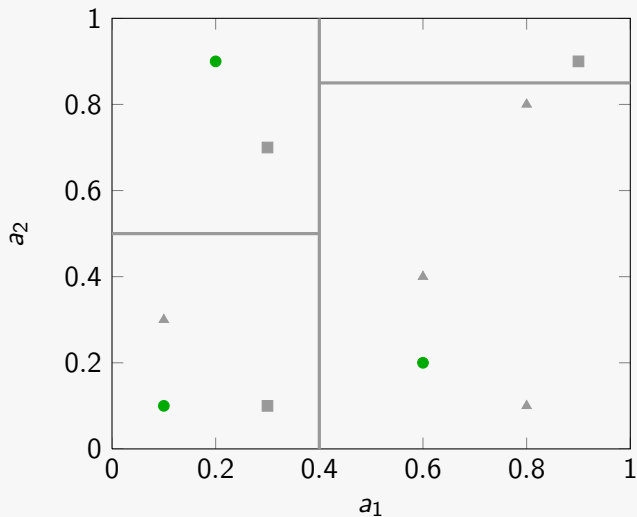
AdaProp: Example Dataset



↓

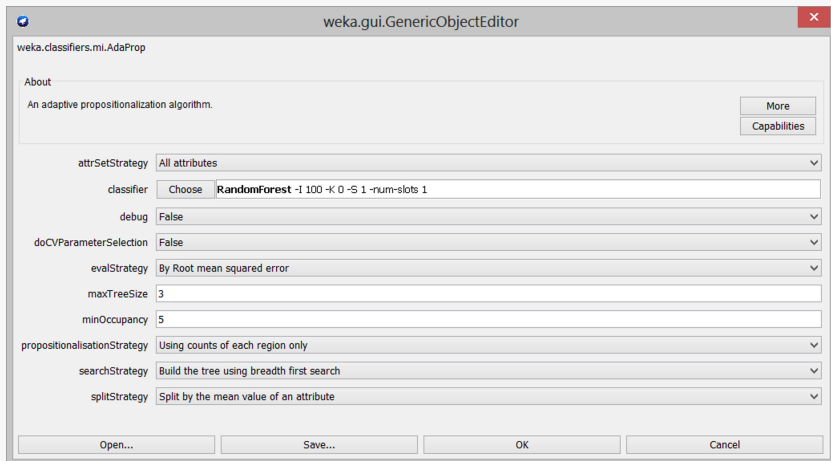
$$\begin{bmatrix} 0 \\ 0 \\ 1 \\ 3 \end{bmatrix}$$

AdaProp: Example Dataset

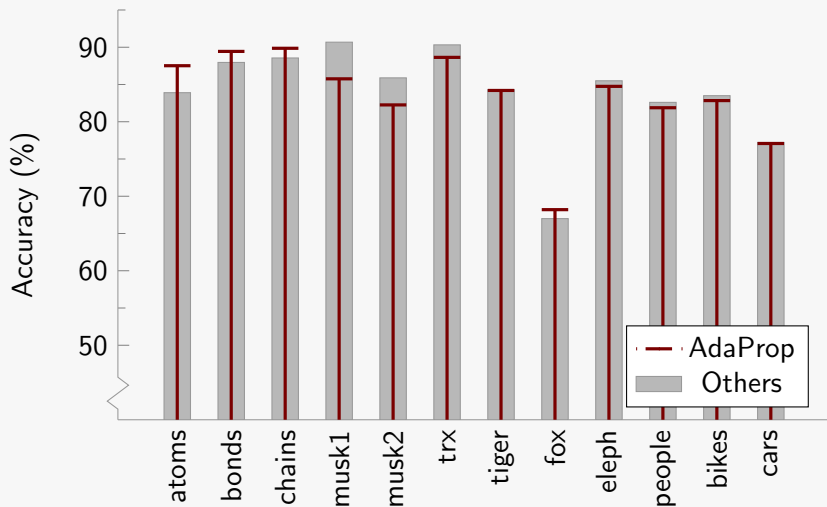


$$\begin{bmatrix} 1 \\ 0 \\ 1 \\ 1 \end{bmatrix}$$

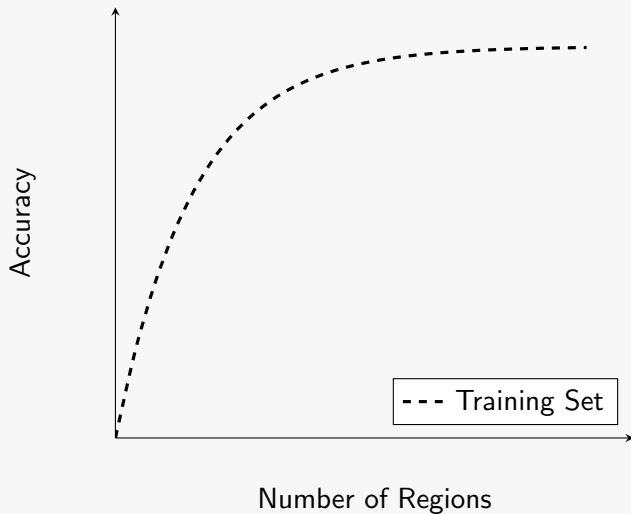
WEKA



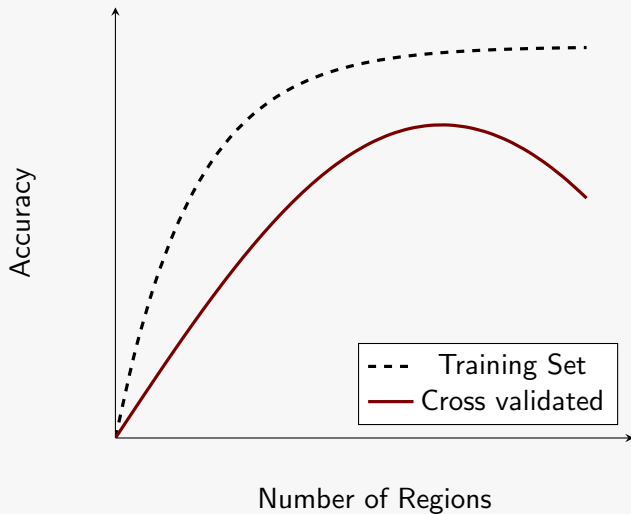
AdaProp vs. Other MI algorithms



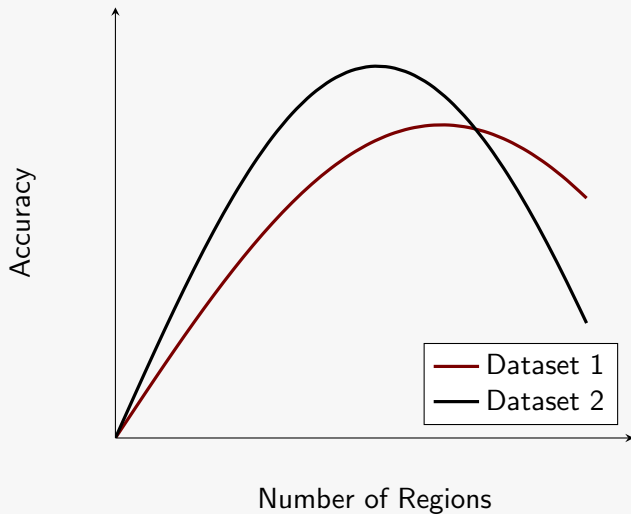
Region Count Parameter Selection



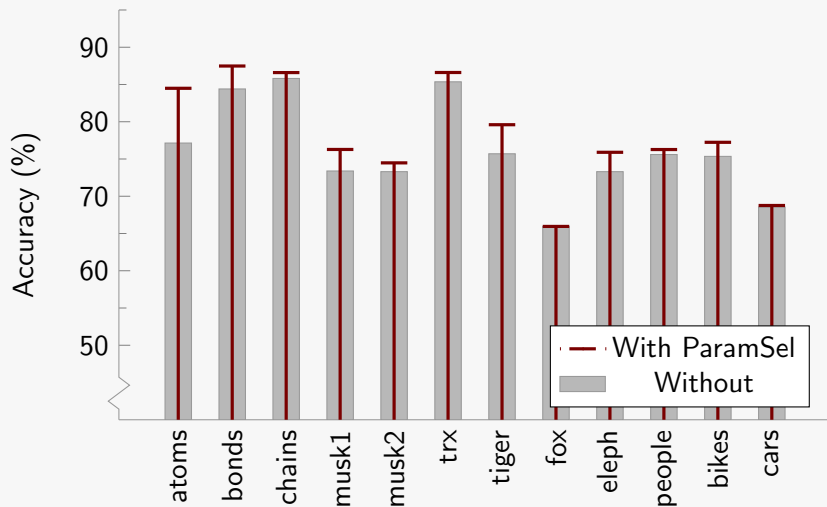
Region Count Parameter Selection



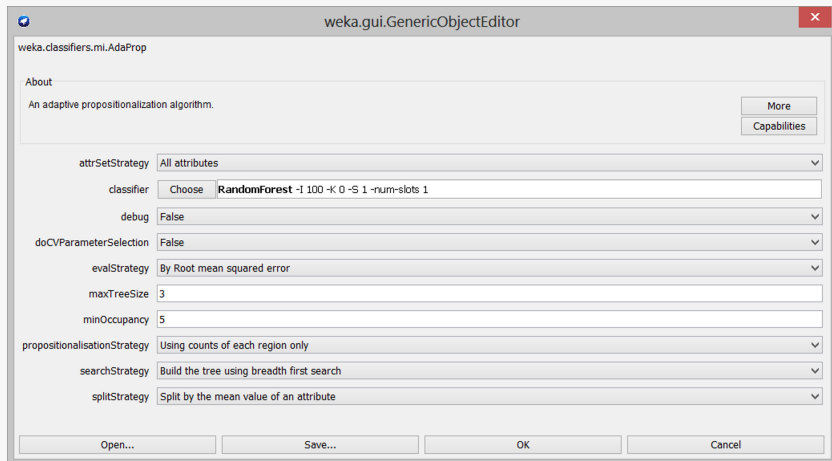
Region Count Parameter Selection



Impact of Parameter Selection



WEKA



Summary

- MI representation is **natural** for Image Classification.
- AdaProp propositionalises MI data using the **base learner**.
- **Comparable performance** to other MI algorithms.