Machine learning methods applied to the analysis of central exclusive production events in ALICE

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Outline

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ML: an overview

In general ML represents a contrast to a *rule based systems*

Rule-based system

System that uses rules to make deductions or choices

- Domain-specific expert system

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ML: an overview

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System that uses rules to make deductions or choices

- Domain-specific expert system
- Knowledge base: facts & rules (if $\rightarrow$ then statement)
- Rules manually specified (by expert) $\rightarrow$ expensive, incomplete

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Machine learning

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  → no human needed

ML: an overview

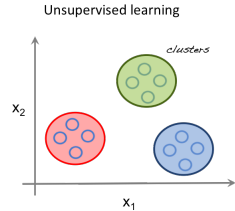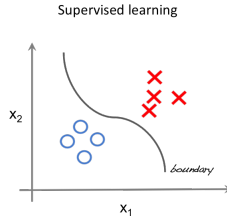In general ML represents a contrast to a *rule based systems*

Machine learning

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- Automatic methods → no human needed
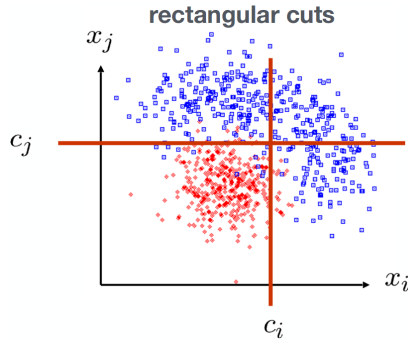- Human work required for defining problem & assessing the data

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Types of ML

- Supervised
  - Classification
  - Regression
- Unsupervised

Supervised learning

Unsupervised learning

Rectangular cuts

Standard cut in one variable

- Cuts only in lower-dimensional subspaces

rectangular cuts

Rectangular cuts

Standard cut in one variable

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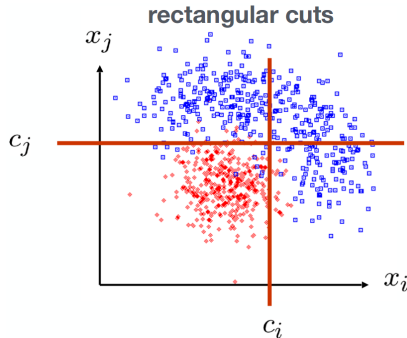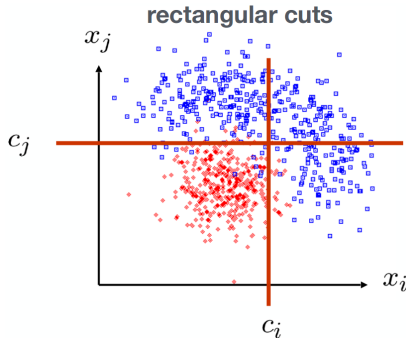- Ignores possible dependencies between the input variables

rectangular cuts

Rectangular cuts

Standard cut in one variable

- Cuts only in lower-dimensional subspaces
- Ignores possible dependencies between the input variables
- Signal might behave like BG in several observables
  $\rightarrow$ misclassification

rectangular cuts

Rectangular cuts with *decision trees*

- Simple & rather old model (*60s*, *70s*)
- Tree-like graph $\rightarrow$ flowchart
- Easy to understand
- Either be manually modelled by experts or learned from training data

Rectangular cuts with *decision trees*