



Università degli Studi di Bari  
Dipartimento di Informatica



LACAM Laboratory  
Machine Learning

# Fast and Accurate Density Estimation with Extremely Randomized Cutset Networks

Nicola Di Mauro, Antonio Vergari, Teresa M.A. Basile and Floriana Esposito

19th September - **ECML-PKDD 2017** - Skopje, Macedonia

# Outline

- Introduction
  - Motivation
  - Problem Statement
  - Scope
- Literature Review
  - Existing Research
  - Gaps in the Literature
- Methodology
  - Research Design
  - Data Collection
  - Analysis Techniques
- Results
  - Descriptive Statistics
  - Hypothesis Testing
  - Regression Analysis
- Discussion
  - Interpretation of Findings
  - Implications
- Conclusion
  - Summary
  - Future Research

# Density Estimation

# Tractable Probabilistic Models (TPMs)

# Cutset Networks (CNets)

# Learning CNets

# XCNets

by [S. Wang](#)

[@Siliwangi](#)

[siliwangi@cs.cmu.edu](#)

[siliwangi@cs.cmu.edu](#)

[siliwangi@cs.cmu.edu](#)

[siliwangi@cs.cmu.edu](#)

[siliwangi@cs.cmu.edu](#)

[siliwangi@cs.cmu.edu](#)

[siliwangi@cs.cmu.edu](#)

[siliwangi@cs.cmu.edu](#)

[siliwangi@cs.cmu.edu](#)

[siliwangi@cs.cmu.edu](#)

# Mixture of Experts



# Regularization

Regularization is a technique used to prevent overfitting in machine learning models. It involves adding a penalty term to the loss function, which discourages the model from fitting the training data too closely. This helps the model generalize better to new, unseen data.

There are several types of regularization, including L1 (Lasso), L2 (Ridge), and Elastic Net. L1 regularization adds a penalty equal to the absolute value of the magnitude of the coefficients, while L2 regularization adds a penalty equal to the square of the magnitude of the coefficients. Elastic Net combines both L1 and L2 regularization.

Regularization is particularly useful in high-dimensional data where the number of features is much larger than the number of samples. It helps to reduce the variance of the model, leading to more stable and accurate predictions.

In practice, regularization is often implemented using software libraries like scikit-learn in Python. The regularization parameter, often denoted as  $\lambda$ , can be tuned using cross-validation to find the optimal balance between minimizing the loss and maximizing the model's generalization.

Overall, regularization is a crucial tool in the machine learning toolbox, helping to build models that are not only accurate but also robust and interpretable. By controlling the complexity of the model, regularization ensures that the model captures the underlying patterns in the data rather than just memorizing the training set.

# Single Model Comparison

# Ensemble Model Comparison

# Learning Times

# Conclusions

• The proposed model is able to predict the number of cases in the future with a high accuracy.

• The proposed model is able to predict the number of cases in the future with a high accuracy.

• The proposed model is able to predict the number of cases in the future with a high accuracy.

• The proposed model is able to predict the number of cases in the future with a high accuracy.

• The proposed model is able to predict the number of cases in the future with a high accuracy.

• The proposed model is able to predict the number of cases in the future with a high accuracy.

• The proposed model is able to predict the number of cases in the future with a high accuracy.

• The proposed model is able to predict the number of cases in the future with a high accuracy.

• The proposed model is able to predict the number of cases in the future with a high accuracy.

• The proposed model is able to predict the number of cases in the future with a high accuracy.

• The proposed model is able to predict the number of cases in the future with a high accuracy.

• The proposed model is able to predict the number of cases in the future with a high accuracy.

• The proposed model is able to predict the number of cases in the future with a high accuracy.

• The proposed model is able to predict the number of cases in the future with a high accuracy.