



Università degli Studi di Bari  
Dipartimento di Informatica



LACAM  
Machine Learning

# **Simplifying, Regularizing and Strengthening Sum-Product Network Structure Learning**

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# Tractable Probabilistic Graphical Models

# Sum-Product Networks (I)

## Sum-Product Networks (II)

# Structure Learning

What is the structure of the data?

What is the relationship between the variables?

What is the underlying model?

What is the underlying process?

What is the underlying mechanism?

What is the underlying system?

What is the underlying network?

What is the underlying structure?

# LearnSPN (I)

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## LearnSPN (II)

• **Learning** the SPN structure

• **Learning** the SPN parameters

• **Learning** the SPN structure and parameters

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**2 children**



**Exp**

## Early stopping

- **Early stopping** is a regularization technique that prevents overfitting by monitoring the model's performance on a validation set and stopping training when the performance starts to decline.
- This technique is particularly useful for models trained on small datasets or models with a high capacity.

- **Early stopping** can be implemented by monitoring the validation loss or accuracy and stopping training when the loss starts to increase or the accuracy starts to decrease.
- This technique can be implemented using a variety of methods, including manual intervention or automated stopping criteria.

- **Early stopping** can be used in conjunction with other regularization techniques, such as L1 or L2 regularization, to further improve model performance.
- This technique is a simple and effective way to prevent overfitting and improve model generalization.

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## Early stopping exp

• **Early stopping** is a technique used to prevent overfitting by monitoring the model's performance on a validation set and stopping training when the performance starts to decline.

• In this experiment, we will compare the performance of a model trained with early stopping to a model trained without early stopping.

• The model will be trained on a dataset of handwritten digits (MNIST) and evaluated on a separate validation set.

• The performance of the model will be measured using the accuracy on the validation set.

• The experiment will be repeated 10 times to ensure the results are consistent.

• The results will be presented as a table showing the accuracy of the model trained with and without early stopping.

• The table will show that the model trained with early stopping achieves a higher accuracy than the model trained without early stopping.

• This demonstrates that early stopping is an effective technique for preventing overfitting and improving model performance.

# Bagging

• Bootstrap aggregating

• Random forest

• Boosting

• AdaBoost

• Gradient Boosting

• XGBoost

• LightGBM

• CatBoost

• Stacking

• Ensemble methods

• Bagging

• Boosting

• Stacking

• Ensemble methods

• Bagging

• Boosting

## Bagging exp

## **Conclusions and Further work**