Fakultät für Informatik
Technische Universität München

Uncertainty Estimation for I.I.D., Graph, and Sequential Data

Bertrand Charpentier

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Vorsitzender:
Prof. Dr.- Vorname Nachname

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Abstract

This is the abstract.

Zusammenfassung

This is the german abstract.

Acknowledgements

This is the Acknowledgements.

Contents

Part I

Introduction

1 Introduction

1.1 Motivation

- Practical motivation: trust, security, maintenance, fairness
- Philosphical motivation: Dunning-Kruger effect
- Physics motivation: non deterministic world, nothing is fully observable, uncertainty principle

1.2 Contributions

1.3 Own Publications

The publications devides in three topics:

- Uncertainty estimation (incl. sparse NN and Energ-based models)
- Structure learning (incl. hierarhical, scikit-network and DAG learning)
- Efficient models (incl. pruning)

2 Background

- Desiderata: Epistemic and aleatoric uncertainty (and all their other names), uncertain when it does not know, efficient, architecture-agnostic, robustness.
- Models: Sampling-based (Ensemble, DropOut, BNN) vs Sampling-free (GP, Posterior, Conformal).
- Evaluations: Calibration, OOD detection, OOD generalization, Shifts, Benchmarks.

Part II

Uncertainty Estimation for I.I.D. data

3 Uncertainty Estimation for Classification

4 Uncertainty Estimation for Regression

5 Robustness of Uncertainty Estimation

Part III

Uncertainty Estimation for non-I.I.D. data

6 Uncertainty Estimation on Graphs

7 Uncertainty Estimation on Asynchronous Time Events

8 Uncertainty Estimation for Reinforcement Learning

Part IV

Conclusion

9 Retrospective

- Analysis of optimization, core-architecture, latent space, prior.

10 Conclusion

10.1 AI alignment/Reliable ML beyond Uncertainty Estimation

- (Adversarial) Robustness
- Interpretable ML
- Green AI

10.2 Broader Impact

10.3 Open Questions

- Uncertainty Estimation for Active/Online Learning.
- Uncertainty Estimation for Robustness.
- Uncertainty Estimation for Interpretability.
- Uncertainty Estimation and Causality.
- Uncertainty Estimation in the regime of very large data.

Bibliography

A Additional Stuff

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