Tosca Lechner

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Research Interests

Machine Learning Theory, Strategic Classification, Algorithmic Fairness, Transfer Learning, Distribution Learning, Adversarial Robustness, Interpretable Machine Learning

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Education

01/2019-Present

University of Waterloo, Cheriton School of Computer Science.
Doctor of Philosophy (Ph.D.) in Computer Science.
- **Advisor:** Prof. Shai Ben-David.
- **Research Areas:** Machine Learning Theory, Fairness and Interpretability of ML models.
- **Relevant Courses:** ML techniques for Systems and Systems for ML, Security and Privacy for AI and ML, ML in Bioinformatics.

04/2015-12/2018

Eberhard Karls University Tübingen.
Masters in Cognitive Science.
- **Advisors:** Prof. Ulrike von Luxburg and Prof. Ruth Urner.
- **Thesis:** Domain Adaptation Under Causal Assumptions.
- **Specialization:** Machine Learning Theory.
- **Relevant Courses:** Machine Learning: Algorithms and Theory, Machine Learning Theory, Deep Neural Networks.

05/2011-03/2015

LMU, Ludwig Maximilian University of Munich.
Bachelors Degree, Major in Mathematics, Minor in Computer Science.
- **Advisor:** Prof. Christina Kuttler.
- **Thesis:** Comparison of the Hodgekin-Huxley-Model to the Fitzhugh-Nagumo-Model.
- **Specialization:** Mathematical Modeling of Biological Systems.
- **Relevant Courses:** Logic, Theory of Computation, Stochastics, Numerical Analysis, Randomized Algorithms.

Publications

Distribution Learnability and Robustness, *Shai Ben-David, Alex Bie, Gautam Kamath*, **Tosca Lechner**, accepted to NeurIPS 2023.

Adversarially Robust Learning with Uncertain Perturbation Sets, **Tosca Lechner**, *Vinayak Pathak, Ruth Urner*, accepted to NeurIPS 2023.

On the Impossibility of Scale-Insensitve Characterizations of Distribution Learning, **Tosca Lechner**, *Shai Ben-David*, under submission.

Inherent Limitations of Multi-Task Fair Representations, **Tosca Lechner**, *Shai Ben-David*, CoLLAs 2022 (oral), extended arxiv version with Nivasini Ananthakrishnan and Sushant Agarwal.

Learning Losses for Strategic Classification, **Tosca Lechner** *and Ruth Urner*, AAAI-2022 Main Technical Track (oral), also Spotlight at the Workshop on Learning and Decision-Making with Strategic Feedback - Workshop @ NeurIPS 2021, Spotlight at Learning with Strategic Agents Workshop (LSA) 2022.

Open Problem: Are all VC-classes CPAC learnable?, *Sushant Agarwal, Nivasini Ananthakrishnan, Shai Ben-David*, **Tosca Lechner**, *Ruth Urner*, COLT 2021 Open Problems.

Identifying Regions of Trusted Predictions, *Nivasini Ananthakrishnan, Shai Ben-David*, **Tosca Lechner**, *Ruth Urner*, UAI 2021.

Point-wise Confidence Scores for Binary Classification Models, *Nivasini Ananthakrishnan, Shai Ben-David*, **Tosca Lechner**, accepted as poster for SafeAI 2021.

On Learnability with Computable Learners, *Sushant Agarwal, Nivasini Ananthakrishnan, Shai Ben-David*, **Tosca Lechner** *and Ruth Urner*, ALT 2020.

Other Research Experience

06/2023- 09/2023	**Research Internship Machine Learning; Topic: Algorithmic Fairness**, *Apple*, mentors: Ali Mousavi, Yunyao Li.
09/2017- 05/2018	**Research Assistant, "Transfer Learning under Causal Assumptions"**, *Max-Planck-Institute for Intelligent Systems, Tübingen, Advisors: Ruth Urner, Berhard Schölkopf.* We analysed several formalizations of the criterion of 'Independence of Cause and Mechanism' to yield guarantees for domain adaptation. We proved lower bounds on the sample complexity of domain adaptation learners for cases with additional assumptions on the underlying causal data-structure.
06/2017- 07/2017	**Research Assistant, "Theory of Machine Learning"**, *Max-Planck-Institute for Intelligent Systems, Tübingen, Advisor: Ruth Urner.* We extended guarantees for domain adaptation from binary to multi-label classification setting.
05/2016- 09/2016	**Research Internship, "Transmission of signals between prefrontal and parietal neurons involved in numerosity processing"**, *University of Tübingen, Department: Biology, Animal Physiology, Chair: Andreas Nieder.* We analysed single cell neural data from two brain-regions involved in numerosity processing for Granger causality to detect possible top-down processing.

Teaching Experience

10/2011- Present	**Teaching Assistant, "Analysis I", "Linear Algebra I & II", "Machine Learning Theory", "Logic", "Introduction to AI", "Algorithms","Computer Organization and Design"**, *, conducted tutorials and graded assignments and exams.*
04/2015- 07/2016	**Instructor, "Mathematics and Statistics"**, *University of Applied Sciences Neu-Ulm, gave 4 hour long lectures each week, conducted tutorials and conceived and marked exams.*

Scholarships & Awards

UWaterloo Apple PhD Fellowship, *May 2022-April 2024*, 37500\$(CAD)/year.

Vector Research Grant, *Vector Institute, Toronto*, Sept 2020-Sept 2021, Sept 2019 -Sept 2020, Jan 2019-Sep 2019, 6000\$(CAD), 6000\$(CAD), 3000\$(CAD) respectively.

Provost Doctoral Entrance Award, *University of Waterloo*, Jan-Dec 2019, 5000\$(CAD).

PROMOS Travel Scholarship, *University of Tuebingen/DAAD*, Feb-Mar 2018, 750 Euro.

Deutschland-Stipendium, *National German scholarship Programm*, May 2011-Mar 2013, 300 Euro/month.

Reviewer

Conferences	**COLT 2018, IJCAI 2019, ICML 2021, ALT 2021, FORC 2022, NeurIPS 2022, AISTATS 2024**.

Activities

12/2023	**Mentoring round table at WiML@NeurIPS 2023**, *leading round table discussion at Women in Machine Learning workshop.*
06/2022- 08/2022	**Participation at Interpretability in Machine Learning cluster at Simons Insitute, UC Berkeley**, *6 week long research cluster.*
07/2021- 08/2021	**Participation at Deep Learning Theory Summer School at Princeton**, *seven day summer school for Theory of Deep Learning.*
02/2021	**Co-organization of Women in Machine Learning Theory social at ALT 2021 (virtual)**, *co-organized with Ruth Urner.*
04/2013- 10/2016	**Establishment and Organization of the Annual Biomodels Academy⌀, CdE e.V. (students association)**.
10/2012- 11/2014	**Co-organization of math seminars for mathematically gifted girls**, *invited talks on number theory and game theory, co-organization of social activities, organization of transport.*
09/2009- 12/2013	**Member of the board, Quod Erat Demonstrandum e.V.⌀ (students math association)**, *including co-organization of several 4-day math seminars.*

Skills

Languages	**German (native), English (fluent), French (basic).**
Programming	**Python, R, Java, MATLAB.**