CENTER FOR STATISTICS AND MACHINE LEARNING

The Program in Applied and Computational Mathematics

JOINT COLLOQUIUM

Monday, 4:30pm **214 FINE HALL**

IN-PERSON LECTURE

Monday, October 31, 2022

Prof. Ryan Adams, Princeton University

Title: Learning Space-Group Invariant Functions

Abstract: The plane and space groups are groups that specify how to tile two- or three-dimensional Euclidean space with a shape: They enumerate all possible waysin which a shape can be isometrically replicated across the space. I will describe how to explicitly compute approximate eigenfunctions of the Laplace-Beltrami operator on the orbifold defined by any such group.

These eigenfunctions provide a complete L2 basis of all functions on two- or three-dimensional space that are (i) continuous and (ii) periodic with respect to the group. The basis allows us to represent functions that arise as quantum observables of crystalline solids or mechanical meta-materials, to generate random functions respecting the group symmetry, and to compute a form Fourier transform defined by the group. I will also explain how to construct an approximation to the orbifold in a higher-dimensional space and a map onto this embedding. Composing this map with function representations used in machine learning (say a neural network or kernel function) results in machine learning models that respect the group symmetry. This is joint work with Peter Orbanz.

Bio: *Ryan Adams is a machine learning researcher and Professor of Computer Science at Princeton University. Ryan completed his Ph.D. in physics under David MacKay at the University of Cambridge, where he was a Gates Cambridge Scholar and a member of St. John's College. Following his Ph.D. Ryan spent two years as a Junior Research Fellow at the University of Toronto as a part of the Canadian Institute for Advanced Research. From 2011-2016, he was an Assistant Professor at Harvard University in the School of Engineering and Applied Sciences. In 2015, Ryan sold the company he co-founded, Whetlab, to Twitter and he spent three years in industry at Twitter and Google before joining the faculty at Princeton in 2018. Ryan has won paper awards at ICML, UAI, and AISTATS, received the DARPA Young Faculty Award and the Alfred P. Sloan Fellowship. He also co-hosted the popular Talking Machines podcast.*

*******No Colloquium scheduled for Nov 7. **********

*******NEXT: Monday, Nov 14, 2022-Prof. Matt Weinberg (Princeton University) *******

PRINCETON UNIVERSITY