

DALHOUSIE MATHEMATICS COLLOQUIUM

Monday February 25 2019, 3:30 pm, Chase 319

Speaker: Reza Farivar
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*The shape of neural information: representational spaces,
transformations, and a conceptual language*

This talk will explore three distinct problems in neuroscience that I hope can benefit from an applied mathematical perspective that understands the shape of data.

- 1) Representational spaces: we fundamentally believe that neurons and neural ensembles represent information and carry out transformations on this information. We are also confident that the kinds of computations neurons do is highly parallel and non-linear, and include features that are likely oscillatory, sometimes including only a few units in a circuit and at other times including entire populations. I will then explore ideas related to Topological Data Analysis, which I hope will provide us with the tools to probe representational spaces and allow us to draw similarities between different spaces and different measurement modalities.
- 2) Transformation: Neural representations are dynamic and change with experience or task-demands. The kinds of transformations possible is dictated by the nature of representations. Within the ideas of topological data analysis, I discuss what sorts of transformations are meaningful, and explore ideas around how to connect transformations to actual neural processes.
- 3) Conceptual Language: Topology can give us powerful tools for probing the shape of data, but knowing we have a donut or a sphere somewhere in our data is hardly meaningful to any neuroscientist. I discuss our need to have meaning in topological descriptors, such that we can use them to formulate mechanistic models of brain function.