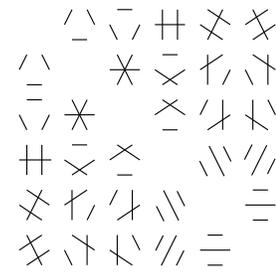


# Mathematics Seminar



## Rocky Mountain Algebra&Combinatorics Seminar

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### Geometry and Expressivity of Neuromanifolds: Where Algebraic Geometry Meets Machine Learning

Maksym Zubkov  
University of British Columbia

In the first part of the talk, I will give an overview of neuroalgebraic geometry, a new field analogous to algebraic statistics, which uses algebraic geometry to understand different neural network architectures. Our main object of study will be a neuromanifold and its geometry. In particular, we will be interested in studying the expressivity of a fixed neural network. A neuromanifold is defined as an embedding of the parameter space of a fixed neural network into a fixed ambient space of functions, while expressivity is defined as the capability of a neural network to approximate an element of the ambient space arbitrarily well. We will study polynomial neural networks through the Zariski closure of a neuromanifold, called a neurovariety, and show that understanding the geometry of a neuromanifold/neurovariety is closely connected to secant varieties and CP-rank tensor decompositions.

### Part II

Maksym Zubkov  
University of British Columbia

For the second part of the talk, we will consider rational activation functions and show how they are connected to Chow varieties and learning the locations of singularities in the data. We will also discuss analogues of neuromanifolds over finite fields, and show how simple point-counting can reveal further insights into the structure of neural networks and the geometry of a neuromanifold over the complex numbers. Finally, we will end with some numerical experiments and future work.

Weber 223  
4–6 pm, Friday, February 20, 2026  
(Refreshments 3:30–4 pm)  
Colorado State University  
4 pm, Friday, February 20, 2026

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This is a joint Denver U / CU Boulder / U of Wyoming / CSU seminar that meets biweekly.  
Anyone interested is welcome to join us at a local restaurant for dinner after the talks.



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