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*Using Machine Learning in Algebra and Geometry.*

The everyday research of a mathematician is typically a series of elaborated guesses that they try to prove or disprove. Often, making the guess, i.e., conjecture, is the most time consuming part. Experience is a factor that reduces the required effort, by aggregating the efforts put for previous conjectures. This is done by introducing a bias towards certain guesses.

In recent years, machine learning, a toolbox for making elaborated guesses, saw a lot of progress and attracted a lot of attention. Machine learning techniques, such as neural networks, have enormous impact in many scientific and engineering fields.

Applying the standard machine learning techniques to mathematical problems is not trivial. Most techniques are developed for applications in computer vision or in general for problems where the data have fixed dimensions. Advances in recurrent neural networks allow for variable size input. In particular, autoencoders can help in this direction.

In this talk we will see how to use machine learning for problems in algebra and polyhedral geometry. We focus on two problems, namely polytope volume prediction and real root counting. We will see how to solve the variable size representation problem and how to use the networks for mathematical exploration. (Received September 15, 2019)