

**Oberseminar Geometrie**  
SPECIAL SEMINAR  
Department of Mathematics  
University of Fribourg  
Room 2.52, Physics Department

**TUESDAY October 30, 2018, 17:15-18:15**



GARY BÉCIGNEUL (ETH Zürich)

## Hyperbolic Geometry in Machine Learning

Machine learning is a field of artificial intelligence that uses statistical techniques to give computer systems the ability to "learn" (e.g., progressively improve performance on a specific task) from data, without being explicitly programmed.

Since hyperbolic geometry can be understood as "tree-like", hyperbolic spaces have recently been used in machine learning to represent data whenever an underlying hierarchical structure is assumed to be meaningful for the task at hand. For instance, impressive empirical results have been obtained for link prediction on the WordNet hierarchy (i.e., given two concepts such as "cat" and "animal", predict whether one entails the other (this directed edge being hidden during "learning")), yielding better accuracy in a 5D Poincaré ball than in a 200D Euclidean space. However, it is sometimes unclear how to generalize to the hyperbolic space common machine learning methods used in the Euclidean space.

In this presentation, we will start by an introduction to machine learning, and will discuss the statistical meaning of the choice of a geometry; we will then introduce related work using hyperbolic geometry in machine learning, and present our adaptations of certain methods to the hyperbolic space, such as certain neural network architectures, multinomial logistic regression and word embedding models. Suggestions by the audience of other geometries to be used in machine learning are very much welcome.