

# CONDENSED MATTER SCIENCES SEMINAR

## Dr Dmitry Semenov

NHMFL Florida State University

Host & Speaker

### Title

## **How Algorithms Learn from Data: An Overview of Machine Learning and Artificial Intelligence.**

Friday, October 17<sup>th</sup>, 2025

1<sup>st</sup> Floor – B101

15:00-16:00

### Abstract

This seminar introduces the fundamental principles and practical methods of modern machine learning, building from basic regression to advanced deep learning models. Starting with the essential concepts of data, models, hypotheses, and cost functions, then develop linear regression using partial derivatives and explore extensions such as batch and locally weighted regression with error analysis. Moving beyond linear methods, we discuss classification problems, including the sigmoid and logistic functions, maximum likelihood estimation, and Newton's method for efficient optimization. The seminar then explores generalized gradient descent algorithms, Naïve Bayes for text classification, and Support Vector Machines with kernel functions for non-linear decision boundaries. We conclude with an overview of deep learning architectures, including neural networks, the ReLU activation, SoftMax outputs, and regularization techniques for optimization. Throughout, illustrative examples—from predicting housing prices to distinguishing cats, lions, and iguanas—highlight both the mathematical foundations and the practical applications of machine learning. Some current scientific AI applications (API) will be presented and discussed.