MACHINE LEARNING IN MEDICINE

Course outcomes:

At the end of the program the student must be able to:

- Appreciate how learning works and how close and how distant the human mind is from computing.
- Be exposed to a formal model in learning
- Convert the model to mathematical algorithms
- Learn the basics of coding for the algorithms.
- Learn how this fits together for improving the practice of medicine and health care

INTRODUCTION [01]

Health care in developing countries like India leaves a lot to be desired. This portion of the course will touch upon the present situation and how digital intervention especially machine learning can help meet the goals. We will look at the various data sources –genomics, imaging and wearables to see how these can come together to help the patient

SOCIETY OF MINDS [02]

Based on Prof. Marvin Minsky's seminal book this lecture will strive to find a scientific framework for learning and lead into the fact that learning can be quantified mathematically and is not as fuzzy as was earlier thought.

FOUNDATIONS /THE THEORY OF LEARNING [03]

Here we lay the foundations of learning.-Statistical methods, ERM(Empirical Risk Minimization), ERM with bias, PAC(Probably Approximately correct) Learning, Finite and Infinite classes. We will also cover fundamentals of the Bias-Complexity trade-off and look at concepts of consistency and hardness of learning

FROM THEORY TO ALGORITHMS [02]

Half spaces, regression etc. leading to SVM (Support Vector Machines). Kernel methods for SVM implementation. Decision trees, Neural Networks, Clustering and Generative models-Naïve Bayes and Bayesian reasoning

SOFTWARE FOR MACHINE LEARNING [03]

Software Architecture, open source and the new API architecture. Introduction to R, Python and other commonly used programming languages.

A look at some readymade tools for Machine Learning, their advantages and disadvantages

CONCLUSION [01]

How does all this fit into medicine? The coming convergence of data from wearables, genomics and imaging creating a patient-doctor dashboard.

References:

1. The Society of Mind-Marvin Minsky.

2. Gödel, Escher and Bach-an eternal Golden Braid-Douglas R. Hofstadter

3. Understanding Machine Learning-From theory to algorithms-Shai Shalev-Shwartz and Shai Ben David.

4. Machine Learning-Tom.M.Mitchell