Imperial College London

Department of Electrical and Electronic Engineering

Final Report 2017

Project Title: **Project 1500572 Adaptive Machine Learning for Utilizing Easy Data**

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Course: **4T**

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| introduction: (overview, structure) |
| Machine learning has become an essential part of many application area—such as problems of advertisement placement, movie recommendation, and node or link prediction in evolving networks—one must make online, real-time decisions and continuously improve performance with the sequential arrival of data. Online machine learning can fulfill these requirements, it can also adapt to a new pattern of data dynamically.  There are many machine learning algorithms support online learning (e.g. nearest neighbor, Naïve Bayes). Moreover, online machine learning involve prediction and classification. In this project, we focus on online prediction problem and the simplest learning rule: Follow the leader algorithm, as well as online convex optimization of the model.  This report begins by introducing the relevant background to the project, including a brief overview of the basic concept of online prediction problem, follow the leader algorithm and online convex optimization. It then outlines the support material of this project. A mathematical analysis of the project follows.  Project objectives and main experiment setting is then detailed which include an evaluation plan of the project, after that a timeline and an implementation plan for future work is followed. And lastly a conclusion is drawn summarizing the work have done so far.  In appendix, project description and details of various papers and support material have been inserted. The python code for FTL is also included. |

Weather forecasting, predicting stock market trends, and deciding which ads to present on a web page are examples of sequential prediction problems. Online learning is a powerful and popular way of dealing with such problems. An online learning algorithm observes a stream of examples and makes a prediction for each element in the stream. The algorithm receives immediate feedback about each prediction and uses this feedback to improve its accuracy on subsequent predictions. In contrast to statistical machine learning, online learning algorithms don’t make stochastic assumptions about the data they observe, and even handle situations where the data is generated by a malicious adversary. There has been a recent surge of scientific research on online learning algorithms, largely due to their broad applicability to web-scale prediction problems.