# 6.S952 Project Task

**Pranay Agrawal (pranay09@mit.edu), Eddy Ogola (ogolaedd@mit.edu)**

**Adapting Parameters to Changing Market Regimes** -

For every trading strategy, there are market regimes that are favorable and other regimes that are not. The idea is to periodically calibrate the optimal parameters of the existing trading strategies to adapt to rapidly changing market conditions.

The aim is to test this for simple technical indicator strategies such as the Bollinger Band(as mentioned in the blog), MACD, etc.

Using ML and continual learning, we try to approximate this objective function using gradient-boosting decision trees by training its nodes using historical data. The inputs will include not only the parameters that we initially set out to optimize but also the set of features that measure the external conditions. For example, to represent a “market regime”, we may include market volatility, macroeconomic conditions, and some other input features. The output of this network would be the future 1-month Sharpe ratio of a trading strategy that we wish to optimize.

One of the challenges would be that this would require training on a lot of data, so we might need to figure out some intelligent sampling methods to sample training data and train the network using that.

Another challenge would be to model this as a continual learning problem. We aim to initially try out existing continual learning methods in other domains and then apply relevant techniques to apply them to this problem.

Reference:

https://predictnow.ai/conditional-parameter-optimization-adapting-parameters-to-changing-market-regimes/
Conditional Portfolio Optimization - https://drive.google.com/file/d/1WdljVbt5JkomxmxzW0O4o-Ed83PtwV_6/view?usp=sharing
This paper proposes a technique named Conditional Portfolio Optimization that adapts to market regimes via machine learning. Using ML, it conditions the optimization on a large number of market features and proposes a portfolio that is optimal under the current market regime.

https://www.researchgate.net/publication/331073237_On_Incremental_Learning_for_Gradient_Boosting_Decision_Trees
The paper proposes an algorithm for incremental learning in data classification using gradient boosting decision tree. It updates the classification model without running gradient boosting from scratch, making it suitable for real-time data.

Gradient Boosting Decision Trees-
https://towardsdatascience.com/machine-learning-part-18-boosting-algorithms-gradient-boosting-in-python-ef5ae6965be4

A temporal continual learning framework for investment decisions
https://openaccess.city.ac.uk/id/eprint/26065/
The thesis introduces temporal continual learning (TCL) as an extension of continual learning (CL) to address concept drift problems in non-stationary time-series domains such as finance. A continual learning augmentation (CLA) is introduced, which uses an external memory structure to store learner parameters from past temporal states for recall in the future.