Capstone 2 Project Proposal [Chris Coble]

Essay Format + Problem Statement Worksheet Format

**“Predicting Necessary Dietary Adjustment for Maximal Muscle Growth”**

As a 24 year old man, I have a desire to gain muscle and consequently weight, but I struggle greatly. I have been on a weight training regimen for 2 months so far (starting March 20th 2024): a resistance based workout plan with 4 days of exercise and 3 days of rest, while eating 3600 calories per day with at least 100g of protein. The original weigh in was at 153lbs, and the current weight after two months of the regimen is 155lbs. The original goal was to gain 10 lbs in 6 months, which would mean I would weigh 163 lbs by September 20th. Clearly, the current pace I am at is not up to speed. I want to identify if there are certain nutrients (vitamins/minerals) that I can maximize intake on, or ensure I consistently get in order to maximally activate the pathways most responsible for muscle growth and consequent weight gain. In summary, I would like to adjust my diet for specific quantities of vitamins/minerals based on machine learning predictions that identify which cellular pathways are most responsible for muscle growth, in order to gain 10 lbs by September 20th, 2024 (weigh in would be 163 lbs if successful).

The process of creating a machine learning model that can predict the nutrients needed most to gain maximal weight will involve many intricate steps starting with data wrangling, exploration, and polishing. The main sources of data will be a study on the pathways most implicated in muscle growth in a resistance training setting and data on the vitamins and minerals required for the operation of those pathways. Once the cellular pathways that have the highest correlation with highest muscle growth are identified, then those pathways can be matched with the corresponding nutrient data. The features, or input data, on the finalized data frame would be: initial muscle size, final muscle size, initial RNA transcript levels, final RNA transcript levels, and the pathways producing those RNA transcripts. The model’s output or prediction would be the nutrient or vitamins required in the pathways, giving guidance to my optimal diet. This is just the first step in this project to aid my weight gain journey.

Next is the actual training of the model and prediction generation. The training and test data would be split first. Then, outliers would be removed and missing values would be imputed, ensuring that no values are missing in the data frame. Then a regression model could be generated, ultimately training the inputs to the outputs: the nutrients needed for maximal weight gain. The test data would be run to see the accuracy of the model, and from those accuracy readings, hyperparameter tuning could be applied to optimize the model. Once the model is optimized, the test data can be included in the final training of the model, and the official predictions can be generated. With the help of machine learning models, there is a high chance of discovering what nutrients I need to maximize intake of in order to maximize my weight gain.

To reiterate, the proposal of this project is to generate a model that can predict the nutrients that I need to increase intake of in order to gain more muscle, specifically to reach 163 lbs by September 20th, 2024. The model will be fed data on muscle growth, corresponding RNA transcripts at time points, and pathways involved in RNA transcript production. The output will be the nutrients associated with the optimal flow of those pathways. Hopefully, this machine learning model can be the key to my success in gaining weight!

**Problem Statement Worksheet Format:**

1. **Problem Context**

As a 24 year old man, I have a desire to gain muscle and consequently weight, but I struggle greatly. I have been on a weight training regimen for 2 months so far (starting March 20th 2024): a resistance based workout plan with 4 days of exercise and 3 days of rest, while eating 3600 calories per day with at least 100g of protein. The original weigh in was at 153lbs, and the current weight after two months of the regimen is 155lbs. The original goal was to gain 10 lbs in 6 months, which would mean I would weigh 163 lbs by September 20th. Clearly, the current pace I am at is not up to speed. I want to identify if there are certain nutrients (vitamins/minerals) that I can maximize intake on, or ensure I consistently get in order to maximally activate the pathways most responsible for muscle growth and consequent weight gain. In summary, I would like to adjust my diet for specific quantities of vitamins/minerals based on machine learning predictions that identify which cellular pathways are most responsible for muscle growth, in order to gain 10 lbs by September 20th, 2024 (weigh in would be 163 lbs if successful).

1. **Criteria for a Successful Solution**

* Reaching goal weight of 163 lbs
* Reaching goal weight by September 20th, 2024
* Identifying key nutrients that heavily participate in the most important cellular pathways involved in muscle growth
* Identifying quantity of nutrients needed for safe, maximal intake

1. **Scope of Solution Space**

* Nutrients and vitamins implicated in cellular pathways
* Cellular pathways most involved in muscle growth
* Dosage of nutrients and vitamins
* Personal weight
* Time of weigh ins

1. **Constraints within the Solution Space**

* Changes in stressors that could impact weight gain or loss
* Body’s response to current medications; medication’s interferance of certain cellular pathways
* Biochemistry of self differing greatly from the biochemistry of the participants in the study
* Accessibility of certain nutrients; is there an easy way to get bioavailable forms of certain vitamins and minerals?

1. **Stakeholders Involved**

* Myself

1. **Data Sources Required**

* Data on genes/pathways involved in muscle growth induced by resistance training
* Data on vitamins and minerals implicated in cellular pathway function