Capstone 2 Report
Nathan Knudsen - Nutrition and Weight Loss

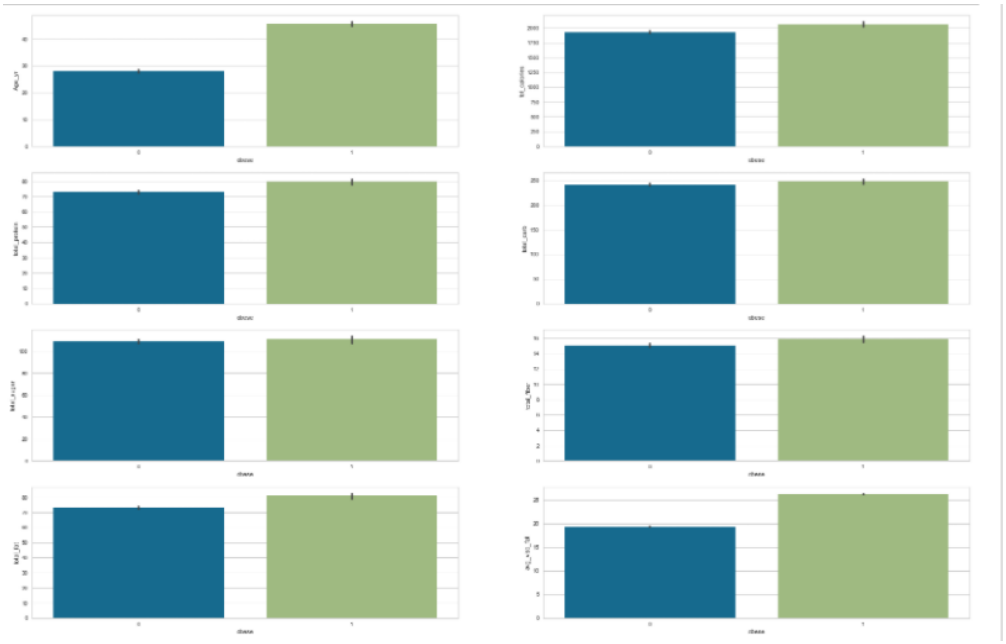
Explain The Problem

Obesity has seen a massive surge in the last few decades and affected many people as the modern world affects the human diet. There has been a lot of research done on this, and a lot of data that has been captured. As this is an interest of mine, I wanted to tackle it head on as part of my capstone in order to continue learning about it and hopefully one day be in a position to help people that have struggled with it. I found a dataset related to a total nutrition and health assessment that was taken by the CDC for the 2013-2014 timeframe. There was an incredible amount of fascinating data available, but I drastically filtered the data down as I was most interested in macronutrients and their effect on different metrics such as BMI and weight.

My Approach

In order to cater to the idea that this would benefit an interested party, I created a fictitious persona by the name of David Greene to one of the obese subjects in the data. I looked at ways that he could eventually get his BMI into a healthy range using the machine learning model and manipulating/tinkering with some of the features related to the client.

Some of the features of my model that were the highest correlated with obesity were unsurprisingly: visceral fat, waist measurement, and weight. Lowering these would obviously bring BMI into a healthy range, but they are more symptoms of obesity rather than inputs/behaviors that will lead to obesity. As this project was mostly focused on the nutrition aspects of health (especially macronutrients), My main features to manipulate will be the ones related to calories such as: total calories, total carbs, total sugars, total protein, and total dietary fat intake.



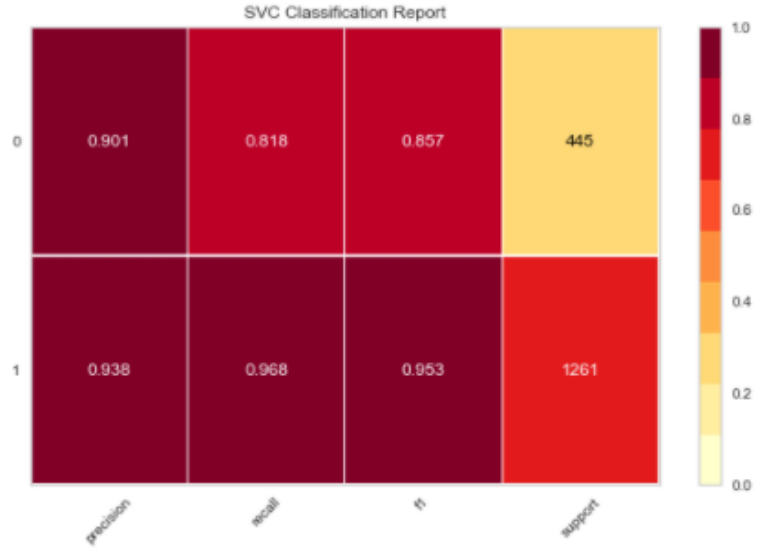
As is shown in the bar barcharts above, the obese subjects (green) had more daily intake in basically all of the categories (even if just barely edging out), this surprised me, until I remembered that our bodies start to utilize energy differently as we age and hormones such as HGH don't get induced as much. This also shows in the first bar chart as it shows that individuals who were obese averaged a higher age than non obese people. This means that even eating similar amounts of food will result in more body fat storage. Interesting stuff!

My Findings

As this is something that I have studied pretty frequently, there was a lot that I knew, but there were some preconceived ideas that I had as well that led me to some pretty interesting insights. First, I was surprised by just how much variability goes into things such as health and physiology. Because of that, I am grateful that I was able to learn about machine learning

models. This way I can rely on what computers are great at rather than having to introduce some aspects of human error (not to mention the additional time that it would have taken).

Our utilized ML model was the Support Vector Machine with 93.8% precision, 96.8% recall, and 95.3% f1 scores.

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5-fold CV Scores:  [0.98103655 0.98073836 0.98894239 0.96562333 0.97980203]
Mean testing score:  0.9792285335030817
Mean training score:  0.9844488669503505
Standard deviation:  0.007554311385645041
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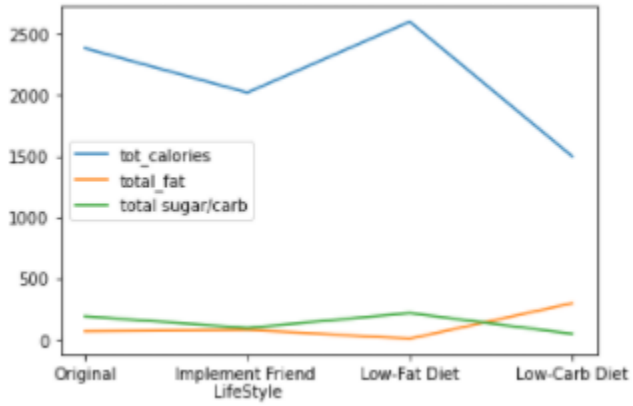
This ML model helped me with my findings, which were consistent with what I hoped to find, in that weight and BMI is highly correlated with chronic behaviors (particularly high sugar intake). By drastically altering Davids food and diet choices, the model determined that he would be able to reach a healthy weight. It was amazing to see this in the data and actually be able to work on something like this. As is shown below in the quick table that I threw together based off of the models results, any scenario where total calories and carbohydrates/sugars were decreased, and healthy dietary fat was increased resulted in success (where BMI would eventually dip beneath 30).

	original	Friends Lifestyle	Low-Fat Diet	Low-Carb Diet
tot_calories	2383	2021	2600	1500
total_fat	70.85	82.95	10	300
total_sugar	193.42	98	220	50
success		YES	NO	YES



Ideas for Further Research

Something that I ran into early on in the process were features related to the subjects intake of macronutrients. I was so excited to see this, but diving into that rabbit hole would have been entirely outside of the scope of what I was hoping to accomplish with this project. I would be very interested in doing some exploratory data analysis related to those features though!

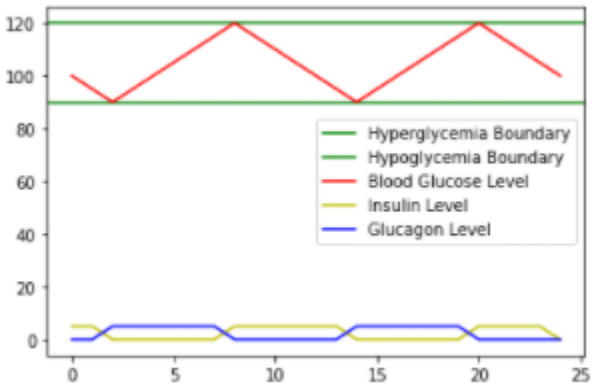
3 Recommendations

Finally, the recommendations that I would give to David (as well as anyone else desperately trying to lose weight), stem from the intermittent fasting/low-carb scenario (#3).

1 - Drastically cut down sugar if not all carbohydrates - for David he will cut his daily intake to 50 grams or less. Sugar induces insulin which makes it impossible to lose weight

2 - Don't be afraid of more dietary fat intake! David can increase his daily intake up to 200 grams. Fat is really good for satiety so you don't feel hungry! Which means that you can eat less calories overall.

3 - Cut down on calories/macronutrients in general. In Davids Scenario, he would cut down in the 1500 calorie range. The recommended daily caloric intake for adult men is 2500 calories, so some people might think this borders on starvation, but if David does it right, his body will dip into a state where he is finally releasing his body fat stores and he can make up the extra 1000 calories from himself. This is what constitutes weight loss!



All of this is possible based off of hormones in our bodies called insulin and glucagon. Whenever our blood glucose levels get low from fasting, glucagon is secreted which will pull stored sugars and fats from our body for our cells to get energy from. Whenever we eat, insulin is secreted which will store any excess energy for later use when our blood glucose levels get low again.

If people like David follow this general advice, in addition to other things like regular exercise, spending time with loved ones, cutting stress out, laughing, sleeping, etc. they will see fantastic results and lead a happier, healthier life!