MAIS 202 Deliverable 2

1. **Problem statement**
- Nowcasting can be highly useful to inform investors on how to better allocate their assets. An accurate nowcast can help mitigate risk and prevent irreversible wealth losses. My goal is to build a nowcasting machine learning model to help investors better navigate the complex world of today.
2. **Data preprocessing**
- FRED-MD is a dataset that is clean already. I set the date as an index and I removed parameters that weren't symmetric with others.
3. **Machine learning model**
   a. PCA to reduce dimensionality for macroeconomic data.
   b. HDBSCAN to identify business cycles and changes in regime
   c. 2 LSTM models: One for the real economy, one for the stock market. Regime changes can shift the weight for both.

The challenge of implementing basic machine learning models is the curse of dimensionality. Therefore, I turned to neural networks such as RNN LSTM. Another challenge I found is that LSTM does not pick up regime changes. Therefore, I programmed something to address this issue.

4. **Preliminary results**
   - Using FRED-MD economic data, I was able to use PCA to reduce dimensionality and HDBSCAN to find the major business cycles. The next steps would be to improve the nowcasting and find out more nuance in the cycles. Additionally, I will try to create a categorical output that will serve as input either in an LSTM model or an FFN.
   - The daily treasury yields were clustering the time series data according to the NBER expansions and recessions. Therefore, it is a negative proxy for predicting business cycles.
5. **Next steps**
- The next step is to design an architecture that englobes the regime change output and the actual stock market prediction neural network. The goal here is to provide the best accuracy for the state of the current market and give a direction to how to move forward.