Artificial Intelligence – The Future of SAA

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Introduction

The foundation of sound Strategic Asset Allocation (SAA) is access to data and the ability to analyse it. In recent years, the amount of available data for fund managers has grown exponentially, making it near impossible to conduct a thorough analysis of it using conventional methods. The benefits of using Artificial Intelligence, such as Machine Learning techniques will act to complement the skills required for fund managers to successfully obtain the best SAA for their portfolios. This paper will briefly go through the fundamentals of Machine Learning, how it will improve the robustness of Macro research and enable the manager to add more value to the SAA process.

Foundational Principles

The key terms used in Machine learning are Features, Labels and Classifiers. Features are the input data into a classifier than returns the labels as the output. To understand these in a concrete way, let's look at an easy and trivial example of comparing apples and oranges:

Features could be the colour and the mass of the fruit. The Labels we look for would be Apple and Orange. The Classifier would work to systematically look at the features and find out the correct label.

Classifiers work as a decision tree. For instance, if the first step in classifying the feature was the colour, then any data point that had the "orange" colour would immediately be classed as an Orange and that anything else would automatically be an Apple. Then we are done. We can also be more prescriptive in the colour classification by including Green and Red as a colour to classify and thus we'd end up with 3 labels, Green Apples, Red Apples and Oranges which gives us a more detailed view of our data set. Either way, the classifier can predict with 100% certainty the fruit based on the colour.

We used only the colour feature to classify the fruit above but what if the only feature in our data was the mass. Well, we now have to look at the mass of the fruits already measured and let's say that on average, Apples weigh over 130g and Oranges weigh less than 130g. We can see now that this classifier will not give a 100% certainty of the fruit as some apples will weigh less than 130g and some oranges will weigh more than 130g. Therefore, the classifier or machine will give us a probability of a correct label given the mass. We may then need to adjust the classifier by selecting a different mass to classify the fruit more accurately.

In order to get more accurate labels from our data, we would need to apply the colour feature as a second step within our classifier to get the correct label. Here we would then have 6 labels, 3 for each type of fruit combined with 2 for the mass above and below 130g or some other mass we could later assign. Clearly, the most efficient 2 step classifier would have been to first use the colour feature and then the mass. Hence the sequence of features used by the classifier is important in both the efficiency and accuracy in obtaining the labels we want.

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Application to Macro Research

In order to obtain the optimal mix of asset classes with a portfolio, it is imperative to determine an accurate view on how these asset classes will perform over a prescribed time horizon as well as how risky they will be. Research has only begun to unlock the potential benefits of using Machine Learning to enhance the asset allocation process. One of the ways is to find useful patterns in the ever-increasing volume of data sets that portfolio managers have access to. Analysis that would take conventional methods too long to process can be efficiently done using the above principles in classifying data.

For instance, looking at various economic data and historical asset class returns and risks can give the manager new insight into how sensitive each asset class is to a given number of economic factors. Classifying periods of positive or negative equity return against changes in GDP growth, interest rates, inflation or FX rates may give us a clearer picture of how strongly these factors that have affected this asset class historically and a deeper insight as to why they have done so.

In the above example of Apples and Oranges, the classifier is a 2-layer neural network, i.e. a 2 step process using the colour and mass features to obtain the labels. With the advent of Big Data we can build much deeper neural networks and thus create a more complex model that can classify a large range of factors to predict the return of the asset classes within a portfolio.

Over time, the model builds a memory of all the results it has computed and will then be able to refine or recalibrate the neural network to classify the data more efficiently. In the case of apples and oranges, the step to classify by mass may change from say the 130g to either 140g or 120g levels depending on how well they classify the fruit. In this way, the classifier for the various economic factors will also recalibrate over time to enhance our understanding of the asset class returns or indeed any property of the asset class we are interested in.

Adding Value

Successful fund management has always depended on quality data and the ability to analyse it. The robustness of any investment process is determined by comprehensive quantitative analysis as well as sound judgement to forecast returns.

A machine learning model as described above will go some way in removing the behavioural biases that could hinder the investment process. The manager can more easily take a holistic view on global financial markets to make an informed decision on the optimal mix of asset classes.

Much of portfolio management theory, such as CAPM, Black-Scholes and Fama-French rely on built in assumptions on factors such as interest rates, volatility, and beta to predict returns. Machine learning models has the advantage of making no assumptions and continuously improves its' parameters over time to make more accurate predictions. Thus, contrary to popular belief, a model built by machine learning techniques will not evolve to replace the fund manager but to act as a useful aid instead.

This type of model can also be used after learning how to classify the data to flag any new patterns that would alter the manager's perspective on the risk/return profile of an asset class. In this way, the manager has more time to perform value added analysis on large data sets as the administrative and computational tasks are fully automated by the model.

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Conclusion

Hence, implementing artificial intelligence will greatly enhance the SAA process in a number of ways while the still placing the onus of the manager to make the decisions on the portfolio. This is because it will not be making the decisions but will try to more accurately model and explain global financial markets. What is needed from the manager is a full understanding of the model as well as the implications of the output. The end result is that machine learning will indeed complement the knowledge and skill of the fund manager to generate better returns on a well-diversified portfolio.