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COVID19 Data Analytics
Homework 3
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Hidden Markov Model for Stock Trading

In this paper, Nguyen details his use of a hidden Markov model for stock trading. Nguyen uses the Akaike information criterion, the Bayesian information criterion, the Hannan–Quinn information criterion, and the Bozdogan Consistent Akaike Information Criterion to test the performances of the HMM with two to six states, then selected the four-state HMM to use for stock price prediction and trading. They then used the four-state HMM to predict monthly stock prices based only on historical prices, then compared their results to those of the historical average return model (HAR) and the Buy & Hold method over different periods. They found that the HMM always outperformed the HAR model, and that overall it outperformed the Buy & Hold method for higher percentage returns.

Gene finding and the Hidden Markov models

This paper begins by detaining traditional gene finding techniques used with prokaryotic cells, where examining the statistical significance of open reading frames works well enough to identify the majority of genes from known proteins. It explains that this same technique does not work well with eukaryotic organisms because of the introns and exons. It explains how HMMs work mathematically, and guides the reader through the process of training and testing that they use to write their code. They then trained the HMM to recognize hydrophilic and hydrophobic segments of cyanobacterial proteins. They then tested their trained HMM on many different pre-annotated proteins and compared their results to the known hydrophobicity. While the HMM worked well in some cases, as with Prochlorococcus Marinus proteins Q46JP5 and A3PB40, it was a poor predictor in others, as with Acaryochloris Marina proteins B0CDA5 and B0CG09.

Can syndromic surveillance help forecast winter hospital bed pressures in England?

This paper aimed to use syndromic surveillance to predict the number the demand for hospital beds in the winter to help avoid deterioration in the health care system. They used daily syndromic surveillance data from 2013 to 2018 and compared the timing of peaks in respiratory indicators with that of daily hospital admittance. After their analysis, they found that seasonal variation in admittance was explained by syndromic respiratory indicators, but that regardless of the syndromic indicators the peak admittance always occurred between Christmas and New Years. Therefore, syndromic surveillance does not help forecast the peak admittance overall, but because they analysed daily data rather than weekly data their models can make real-time predictions for hospital admittance for the rest of the season.