



SOLUTION DESIGN DOCUMENT

MScFE Capstone Project

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09/04/2023

Abstract

Detecting market regimes is a valuable application in finance and economics. The primary purpose of a project focused on market regime detection is to identify and categorize different phases or states of the financial markets over time. Market regimes can be characterized by distinct behaviors, trends, and volatilities, and understanding these regimes can inform trading and investment decisions. In this project, we apply several approaches to identify market regimes using VNIndex historical data.

Environment

Most of the development is done in the local Python Environment version 3.9.2. Some important packages used are listed below.

TA-lib (0.4.19)

Developers and researchers who need to perform technical analysis on data from the financial markets frequently utilize TA-Lib, which provides an open-source API with understanding of candlestick patterns and includes more than 150 indicators, including Bollinger Bands, ADX, MACD, RSI, Stochastic etc.

QuantStats (0.0.59)

QuantStats is a Python package that does portfolio profiling, giving quants and portfolio managers detailed analytics and risk data to help them better understand performance of a strategy.

hmmlearn (0.3.0)

hmmlearn is a popular python module for applying unsupervised learning and inference of Hidden Markov Models

matplotlib (3.3.4)

pandas (1.2.4)

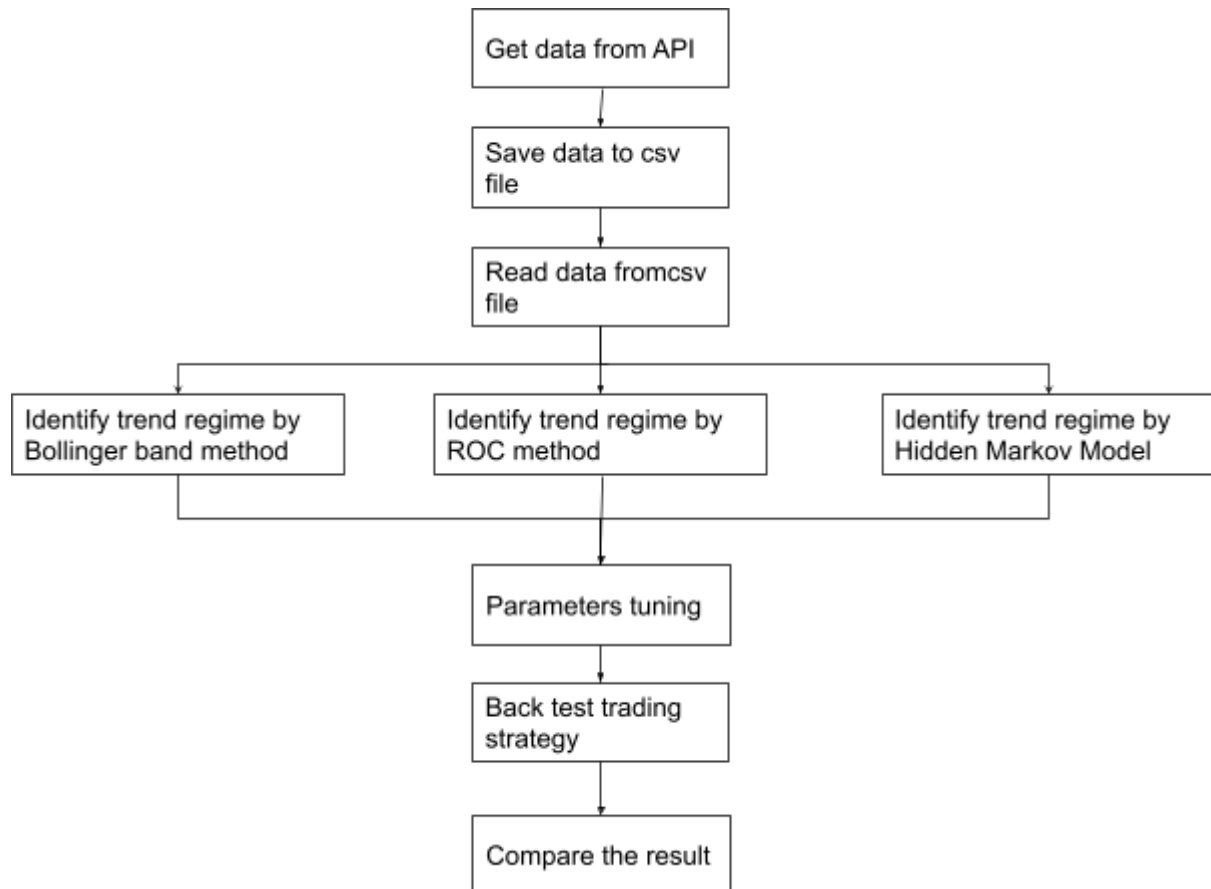
numpy (1.19.5)

Data

The data used is the daily tick data of the Vietnam Ho Chin Minh stock index(VNINDEX)

Implementation

The project work flow:



In this project, we build 2 main classes. The first class is MarketRegimes, which is used to represent a trend and volatility regime of data series. This class has following function:

- **Init:** It initializes data needed to identify regime.
- **market_trend_regimes_bb:** This function is used to identify the trend regime of the data using Bollinger band method
- **market_trend_regimes_ROC:** This function is used to identify the trend regime of the data using Rate of Change method
- **market_trend_regimes_hmm:** This function is used to identify the trend regime of the data using Hidden Markov Model
- **market_volatility_regimes_atrp:** This function is used to identify the volatility regime of the data using Average True Range Percent Method
- **market_volatility_regimes_hmm:** This function is used to identify the volatility regime of the data using Hidden Markov Model
- **market_regimes_plot_color:** This function is used to plot the data combined with the regime's state. There are two ways to display it. One is in the form of lines and the other is in the form of colors

The second class is StrategyPerformance, which is used to represent the performance metrics of trading strategy. This class has following function:

- **init**: this function initializes trading strategy data and calculate all performance metrics of this strategy
- **position_summary**: this function summary all position of the strategy and calculate number of win/lose trades, win rate, average profit and loss
- **profit_factor**: this function calculate the profit factor of the strategy
- **max_dd**: this function calculate the maximum draw down of the strategy
- **CAGR**: this function calculate the cummulative annual growth rate of the strategy
- **volatility**: this function calculate the volatility of the strategy
- **sharpe_ratio**: this function calculate the Sharpe ratio of the strategy
- **strategy_performance**: This function display strategy performance metrics in text format
- **stg_cum_returns_plot**: This function display the cumulative returns of the strategy in graph
- **performance_report**: this function display strategy performance metrics and compare with the benchmark strategy.