

Capstone Project:

Forex Prediction Application

by: Samay Shah



Problem Statement

Canada being a land of immigrants has thousands of new international students and workers landing every year. Most of these people, especially students end up taking loans from banks or lend money from parents to safeguard themselves. Hence paying back all those expenses, plus sending money to support their families abroad becomes one of their prime responsibilities. As a result they are always looking for best exchange rates in order to gain maximum advantage. *With this project my intention is to understand the forex market, and develop an application where people are able to find the best time to transfer money back home.*

Naresh Kumar Gupta asked a question · May 15 at 2:00 PM

INR against CAD has suddenly gone up from INR 56 to INR 60+. Can anyone give reasons for the same and what rate is expected in near future.

Thanks.

115

104 Answers

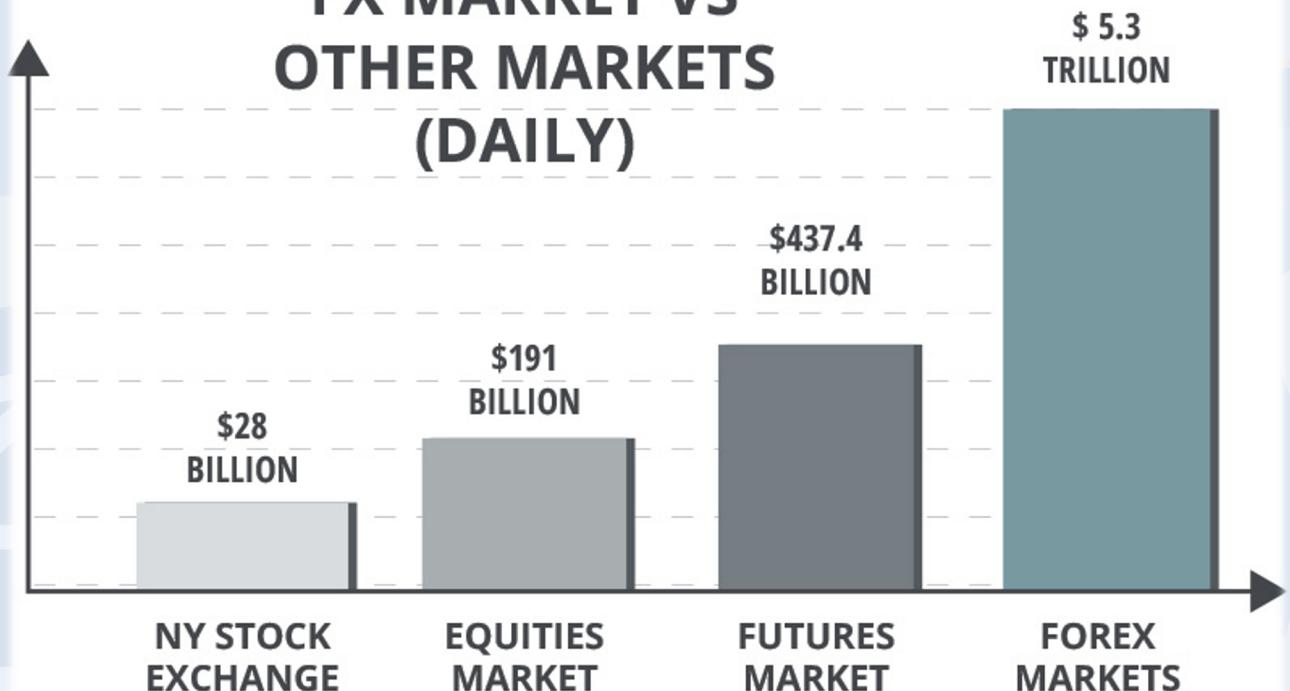
What can you expect.

- Research on the topic
- Understand target audience
- Data Sources and initial data exploration
- My approach on Time Series Analysis
- Compare Metrics / accuracy of prediction.
- Web App Demo and insights
- Future possibilities
- Conclusions

Research

- Understand Forex (FX or currency Market)
- Interesting Facts
- Some principles to consider while trading,
 - ✓ Triangular Arbitrage
 - ✓ Day-of-the-week effect
- Explain CAD/USD versus USD/CAD
- What is Volatility?

FX MARKET VS OTHER MARKETS (DAILY)



FX Market – Dec 2020 (Ref: [Daily FX](#))

Target Audience

- Students – seek for best time to bring money in to pay their tuition fees, or send money back home to pay for the loans or debts.
 - ✓ Ex. CAD/INR, send \$2,000 CAD to India in May 2017 would be Rs. 94,580 while same amount in Sept would get you Rs. 104,640 i.e. almost 10 percent, amount equivalent to buying a good android smart phone.
- Foreign workers – send money back home to support their family.
- Immigrants or traveler's – people looking for best time to book tickets for whole family to travel back home or in some other foreign country and looking for best time to pay for their holiday package.



Example: CAD/INR conversion based on my initial EDA for this project

Data Sources

- Time Period, I decided to include historic datasets from the year 2004 to present day in order to understand the economic shocks that occurred between the year 2006 and 2015.
- Main focus was to identify open use yet reliable sources of data.
- Historic Forex and stock data was obtained from the yahoo finance website, inflation and some GDP data was obtained from fred.stlouisfed.org website, Indian stock market 'SENSEX' data was obtained from bseindia.com/markets website and lastly the Canadian GDP information was made available by the www150.statcan.gc.ca website.



Example: USD Exchange Rate Flow from 2004 to present day (plot from my initial EDA)



Example: UK Exchange Rate Flow from 2004 to present day (plot from my initial EDA)

My Approach on Time Series Analysis

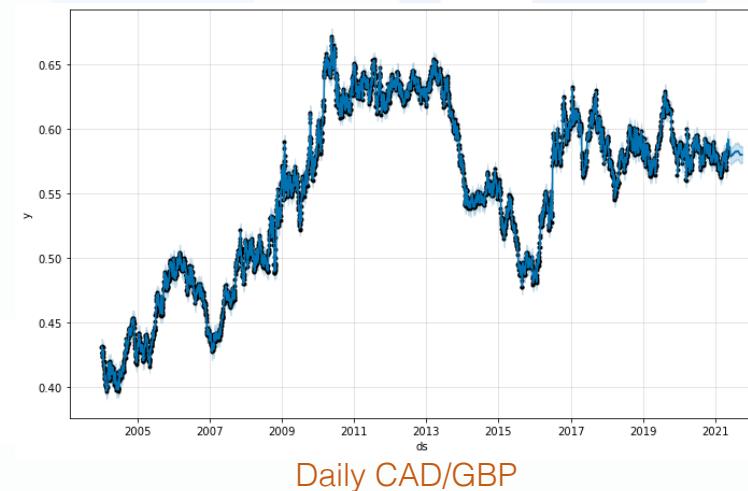
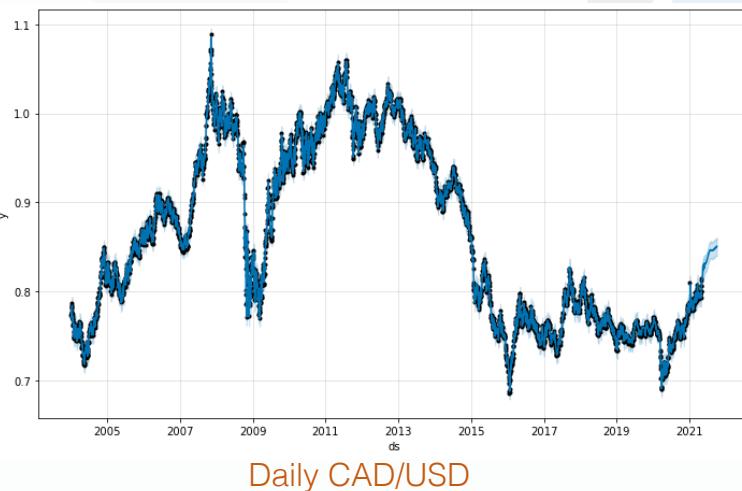
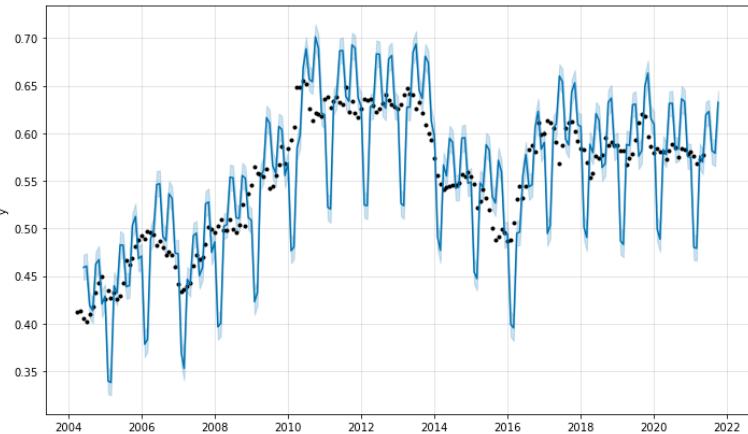
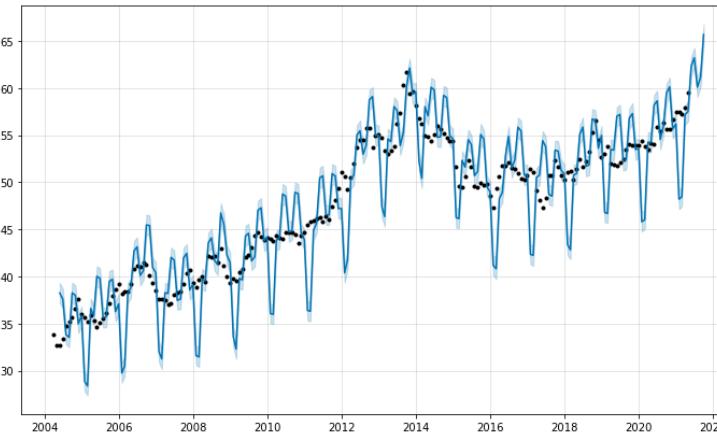
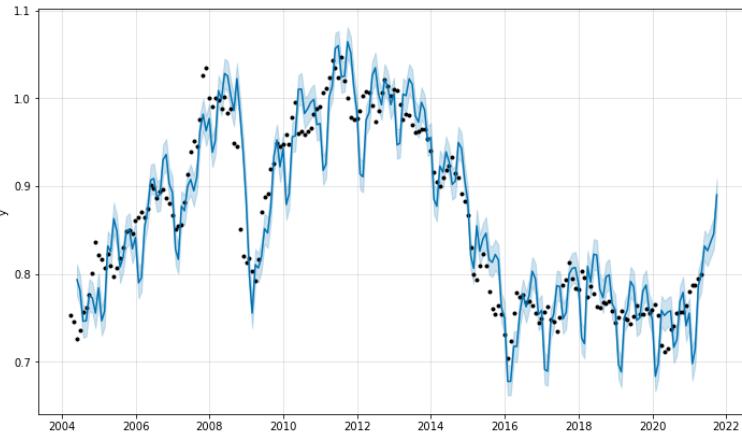
- Gather data
- Clean data, perform imputations
- Exploratory Data Analysis (EDA)
- Univariate Analysis to obtain a base model (using SARIMA and fbprophet)
- Feature Engineering (incorporate rolling average, previous prices etc.)
- Univariate Analysis to obtain exogenous variable data for multivariate modelling
- Multivariate Analysis using different time series models (including SARIMAX, VARMAX, fbprophet etc.)
- Analyze results to check *intuitively* for any errors in prediction
- Compare Results and select the best model
- Build Web Application using Streamlit and deploy using Heroku platform.



Performing Univariate Analysis – Stock Prediction for London Stock Exchange - LSE

Compare Models and Explore trends - 1

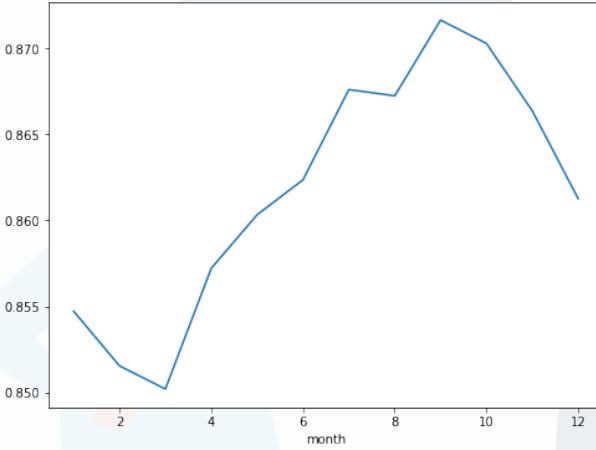
Fitting all features to fbprophet model and understand past trend, seasonality, sudden shocks to later plot the errors in predictions.



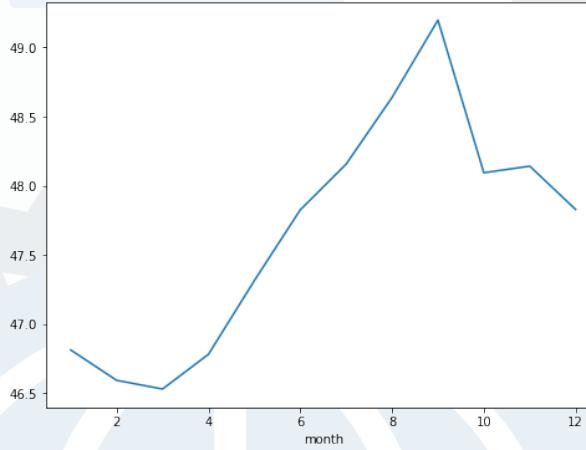
Compare Models and Explore trends - 2

Understanding Mean and Standard Deviations of errors to make decisions based on volatility of that market

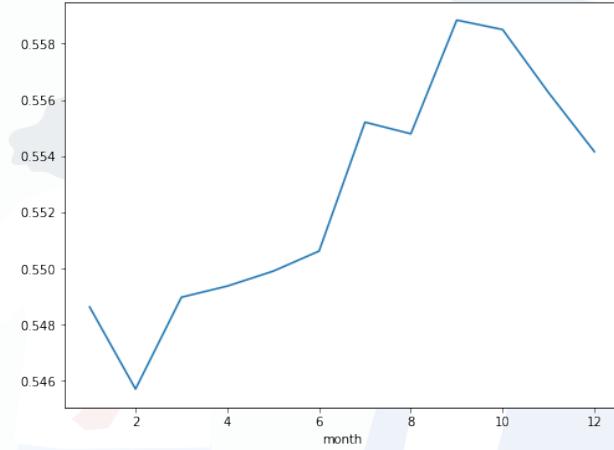
CAD-USD Mean Exchange Rate - Monthly (JAN-DEC 2004-2021)



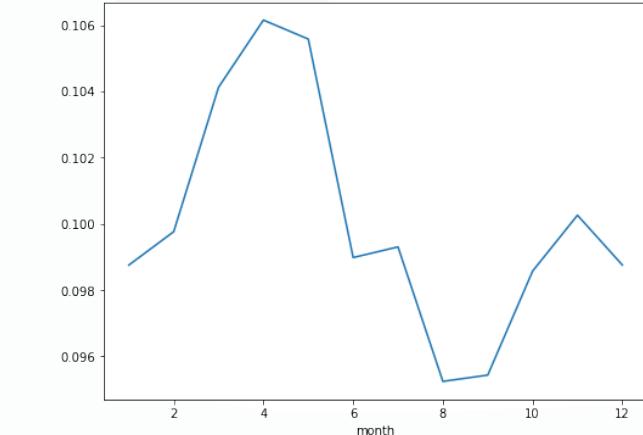
CAD-INR Mean Exchange Rate - Monthly (JAN-DEC 2004-2021)



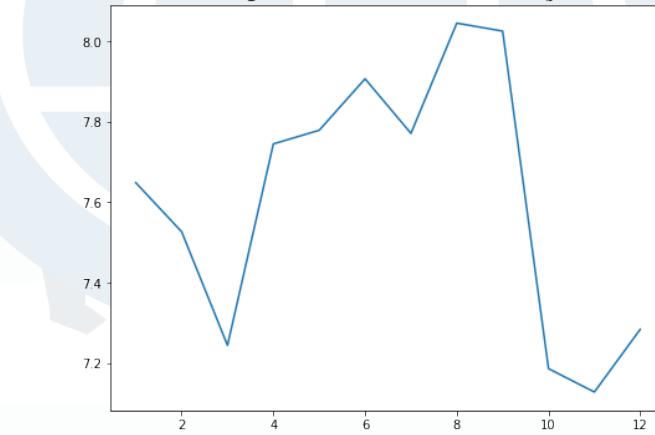
CAD-GBP Mean Exchange Rate - Monthly (JAN-DEC 2004-2021)



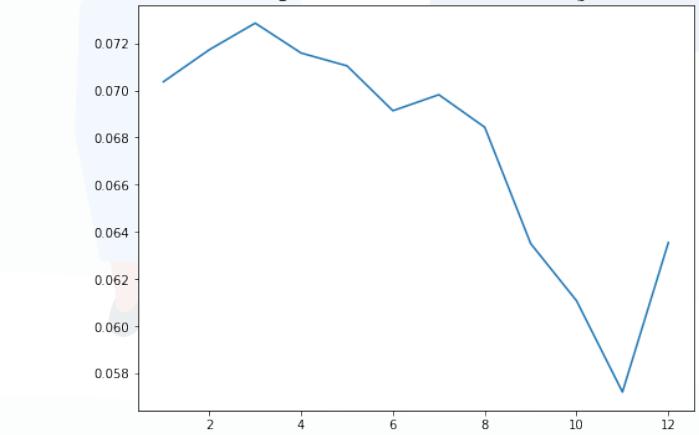
CAD-USD Mean Exchange Rate - Standard Deviation (JAN-DEC 2004-2021)



CAD-INR Mean Exchange Rate - Standard Deviation (JAN-DEC 2004-2021)



CAD-GBP Mean Exchange Rate - Standard Deviation (JAN-DEC 2004-2021)



Comparing Metrics for 3 Models

RMSE for CAD/USD Daily Predictions, 0.002155445884516135
RMSE for CAD/INR Daily Predictions, 0.17741635602914915
RMSE for CAD/GBP Daily Predictions, 0.001527280407950006

RMSE for CAD/USD Monthly Predictions, 0.0195992323896217
RMSE for CAD/INR Monthly Predictions, 0.9525268391462103
RMSE for CAD/GBP Monthly Predictions, 0.03436674578923676

The Models for daily prediction perform clearly better compared to the monthly ones, because month wise only 209 entries were collected while more than 4550 historical observations were collected for modelling the daily data.

	ds	Actual	Predicted
0	2021-05-03	0.5891	0.5825
1	2021-05-04	0.5856	0.5836
2	2021-05-05	0.5853	0.5889
3	2021-05-06	0.5859	0.5854
4	2021-05-07	0.5919	0.5852
5	2021-05-10	0.5877	0.5861
6	2021-05-11	0.5851	0.5917
7	2021-05-12	0.5844	0.5878
8	2021-05-13	0.5865	0.5851
9	2021-05-14	0.5849	0.5846
10	2021-05-17	0.5852	0.5869
11	2021-05-18	0.5859	0.5850
12	2021-05-19	0.5837	0.5854

Predictions from CAD/GBP Test Set

Web Application Demonstration

FOREX PREDICTOR

Predict Exchange Rate against CAD,

Select Currency

GBP

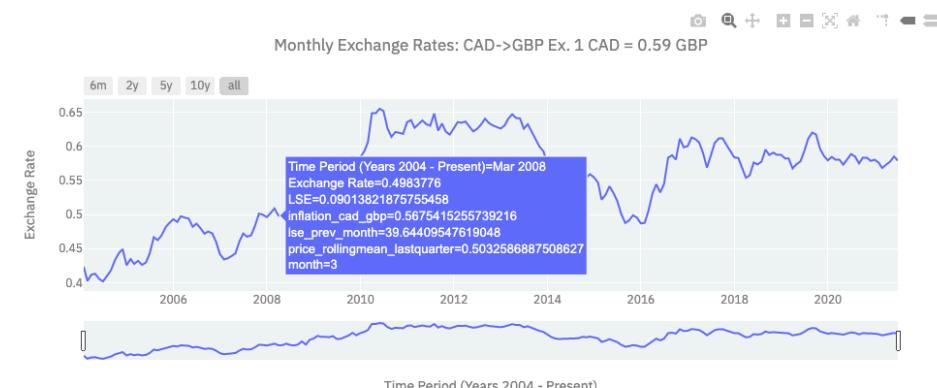
Type of Prediction

Monthly

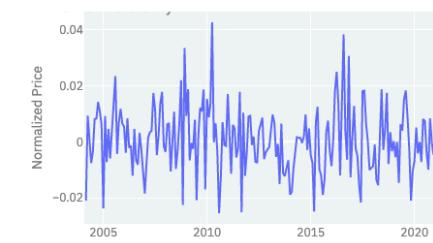
Slide to select # of Months:

1 3 4

CAD to GBP Current Market,



	gbp_open	gbp_high	gbp_low	gbp_close
2021-05-31	0.5851	0.5866	0.5835	0.5851
2021-04-30	0.5775	0.5795	0.5759	0.5775
2021-03-31	0.5732	0.5751	0.5720	0.5732
2021-02-28	0.5682	0.5697	0.5665	0.5681
2021-01-31	0.5762	0.5777	0.5746	0.5761
2020-12-31	0.5804	0.5830	0.5780	0.5804
2020-11-30	0.5787	0.5808	0.5770	0.5787
2020-10-31	0.5833	0.5853	0.5810	0.5833
2020-09-30	0.5834	0.5858	0.5812	0.5835

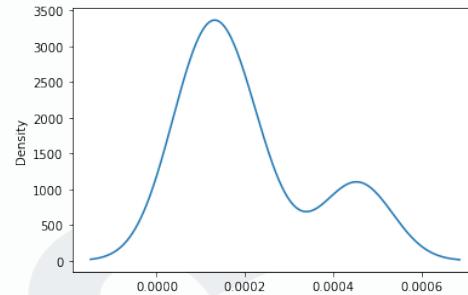


[Demo](#)

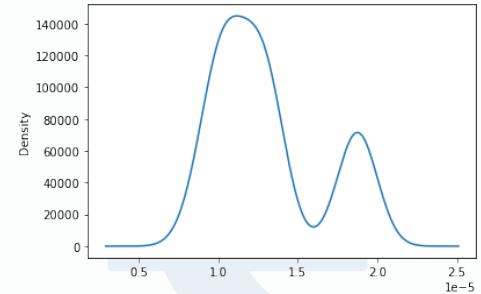
Future Possibilities

1. Try to incorporate more exogenous variables like trade, oil/natural resources, gold and interbank rates to predict the rates.
2. Build models for smaller economies, unlike US and UK the exchange rates for these countries do not depend on a lot of factors and might display some linear trends.

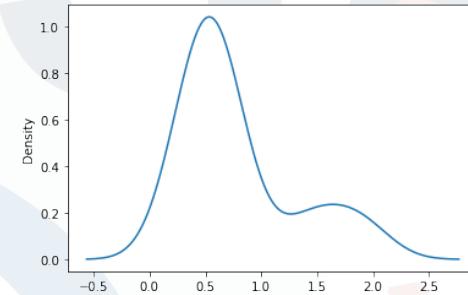
Error/ Residual Plots



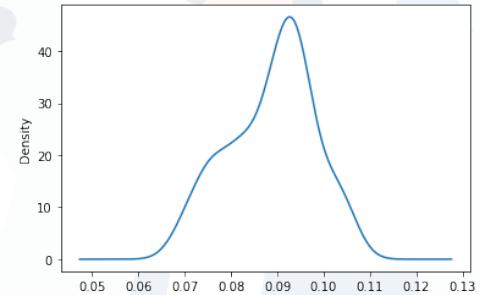
CAD/USD Monthly



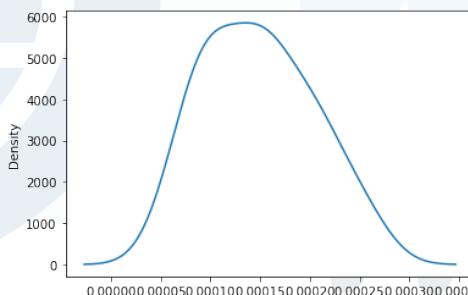
CAD/USD Daily



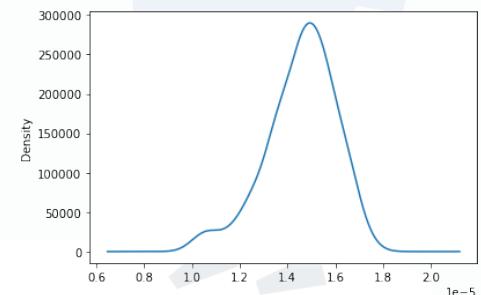
CAD/INR Monthly



CAD/INR Daily



CAD/GBP Monthly



CAD/GBP Daily

References

- My Live Web App is available at, <https://forex-predictor.herokuapp.com/>
- Research paper on techniques to forecast foreign exchange rates by Manav Kaushik and AK Giri ,
<https://arxiv.org/pdf/2002.10247.pdf> (difference of inflation and gdp)
- Modelling with fbprophet by Andrej Baranovskij, <https://towardsdatascience.com/serving-prophet-model-with-flask-predicting-future-1896986da05f>
- Sensex India dataset, <https://www.bseindia.com/markets/equity/EQReports/StockPrcHistori.aspx?flag=1>
- Inflation and GDP datasets, <https://fred.stlouisfed.org/series/GDP>
- Stockmarket and Forex datasets, <https://ca.finance.yahoo.com/quote/CADINR=X/>
- Canada GDP datasets, www150.statcan.gc.ca
- Creating Streamlit Web App by Data Professor, <https://www.youtube.com/channel/UCV8e2g4IWQqK71bbzGDEI4Q>
- Deploying Web App, youtube videos on deploying apps using Heroku by Nachiketa Hebbar,
<https://www.youtube.com/c/NachiketaHebbar/featured>
- Presentation background, www.freepik.com

Thank you.

