Annexure 1: Implementation Results of the Systematic Enhanced Deep Learning Framework for Irregular Sequential Analysis (SeLFISA)

Section A: Results of Irregular Sequential Patterns Analysis

List	Name	Length	Number of IQR Outliers
1	AUD_USD DailyExchaRate from 1990-2016 by Chang et al.(2018)	5906	0
2	GBP_USD DailyExchangeRate from 1990-2016 by Chang et al.(2018)	6135	639
3	CAD_USD DailyExchangeRate from 1990-2016 by Chang et al.(2018)	5000	0
4	SwiFranc_USD DailyExchangeRate from 1990-2016 by Chang et al.(2018)	7015	0
5	CNY-USD DailyExchangeRate from 1990-2016 by Chang et al.(2018)	5000	0
6	NZD_USD DailyExchangeRate from 1990-2016 by Chang et al.(2018)	5000	0
7	JPY_USD DailyExchangeRate from 1990-2016 by Chang et al.(2018)	5000	24
8	SGD_USD DailyExchangeRate from 1990-2016 by Chang et al.(2018)	5000	0
9	Monero CryptoCurrencyDailyRates from 2015-2018 by Glenski et al.(2019)	1208	0
10	S&P from 01-2008_12-2009 by Chalvatzisa et al.(2019)	504	0
11	DJI from 01-2008_12-2009 by Chalvatzisa et al.(2019)	504	0
12	NASDAQ from 01-2008_12-2009 by Chalvatzisa et al.(2019)	504	0
13	S&P500 from 10-2010_09-2016 by Bao et al. (2017) and Chalvatzisa et al.(2019)	1696	0
14	DJI from 10-2010_09-2016 by Bao et al. (2017) and Chalvatzisa et al.(2019)	1513	0
15	NASDAQ from Jan-Dec_2011 by Zhou et al. (2019) and Chalvatzisa et al.(2019)	251	6
16	S&P500 from Jan-Dec_2011 by Zhou et al. (2019) and Chalvatzisa et al.(2019)	251	0

Section B: Summary of Results Produced by Different Best Models

Model	Number of Parameter	Accuracy-Prediction Analysis (GBP_USD Daily Exchange Rate from 1990-2016 by Chang et al. (2018)			Accuracy-Prediction Analysis (JPY_USD Daily Exchange Rate from 1990-2016 by Chang et al. (2018))			Training Efficiency (1)		Stability
		MAE	MSE	R2	MAE	MSE	R2	Time (Seconds)	Efficiency (SelFISA Units)	
Deep LSTM Model influenced by Glenski et. al (2019) and Chalvatzisa et. al (2019)	128513	9.13E-02	2.66E-04	8.89E-01	4.36E-01	2.16E-01	-4.05E+00	4425	29.04248588	125.9021172
Bidirectional LSTMs Model influenced by Sardelicha and Manandhara (2018)	23131	1.67E-02	3.31E-04	9.76E-01	1.72E-01	3.31E-02	2.26E-01	1210	19.11652893	164.599894
Bidirectional GRUs Model influenced by Sardelicha and Manandhara (2018)	17931	5.54E-02	2.36E-03	8.28E-01	3.21E-02	5.61E-03	3.62E-01	963	18.61993769	46.49610679
Attention LSTM Model by Liu (2018)	10276	1.97E-02	2.08E-03	8.85E-01	3.45E-01	1.27E-01	-1.96E+00	3152	3.260152284	178.3931999
SeLFISA Model	**71126**	**1.03E-02**	**2.55E-04**	**9.81E-01**	**1.49E-02**	**3.33E-03**	**4.21E-01**	**7479**	**9.510094932**	**36.50793651**

$$\text{Efficiency (SelFISA Units)} = \frac{\text{Number of parameters}}{\text{Time in seconds}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Stability Based on Percentage Difference = MAE of GBP_USD Dataset (V1) and JPY_USD Dataset (V2)

$$\frac{|V_1 - V_2|}{\left[\frac{(V_1 + V_2)}{2}\right]} \times 100 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

NB: The lower the stability value derived from Equation 2, the more stable the model is.

Section C: Visualisation of Results

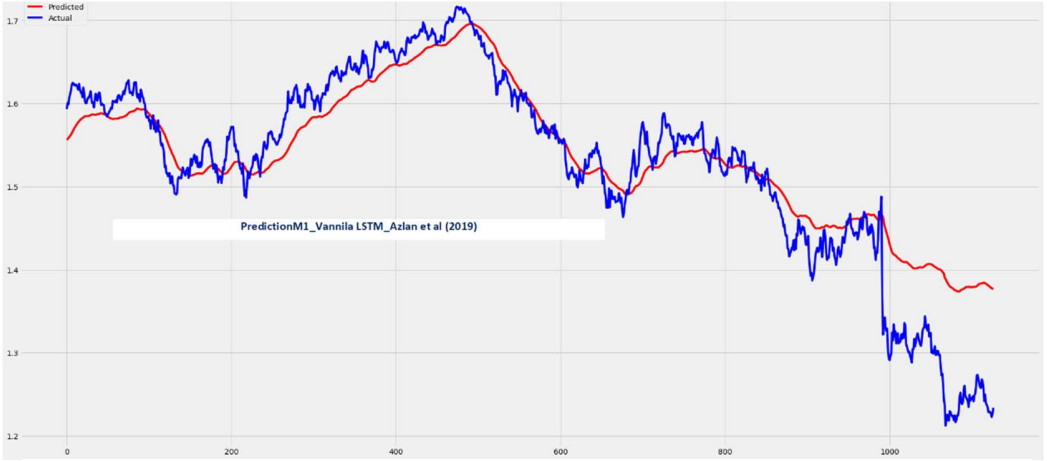

Figure 1- LSTM (32) + Dropout (0.2) + Dense (1) suggested by Azlan et al(2019), Li et. al (2019) and Glenski et. al (2019)

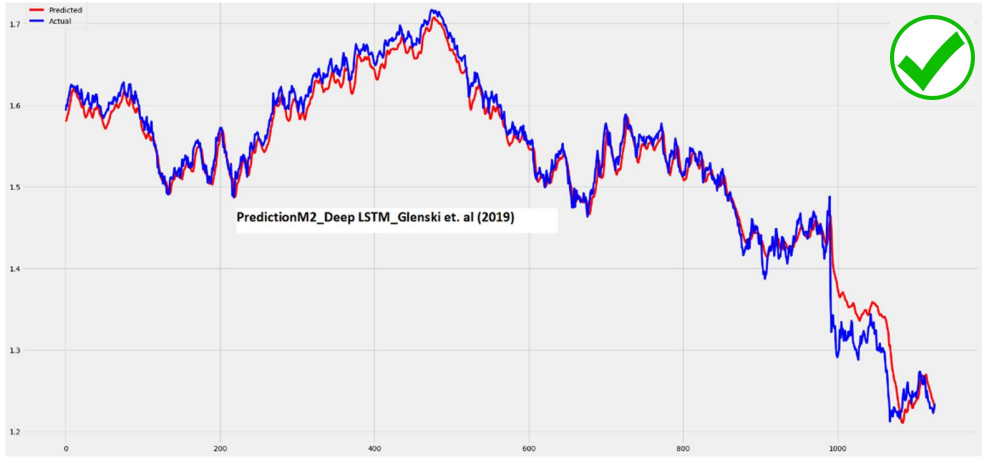

Figure 2- LSTM(32)+LSTM(64)+Dropout(0.2)+LSTM(128)+Dropout(0.5)+Dense(1) by Deep LSTM Model based implemented by Glenski et. al (2019) and Chalvatzisa et. al (2019)

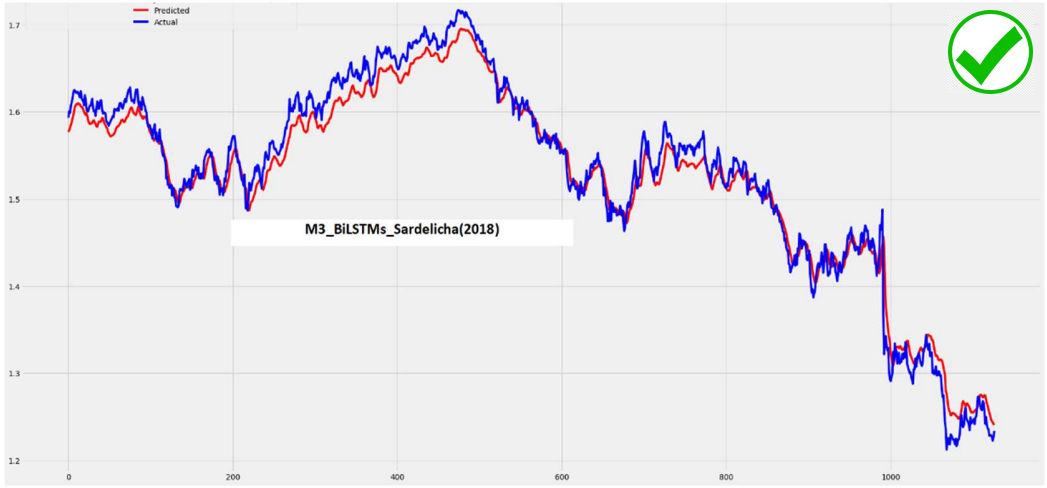

Figure 3- BiD(LSTM(50))+Dense(10)+Dense(10)+Dense(1) influenced by Sardelicha and Manandhara (2018)

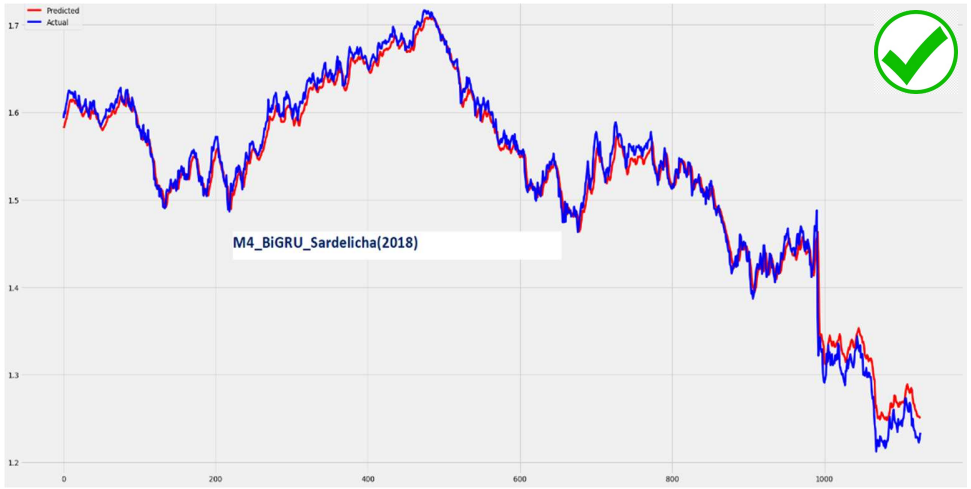

Figure 4 - BiD(GRU(50))+Dense(10)+Dense(10)+Dense(1) by Sardelicha and Manandhara (2018)

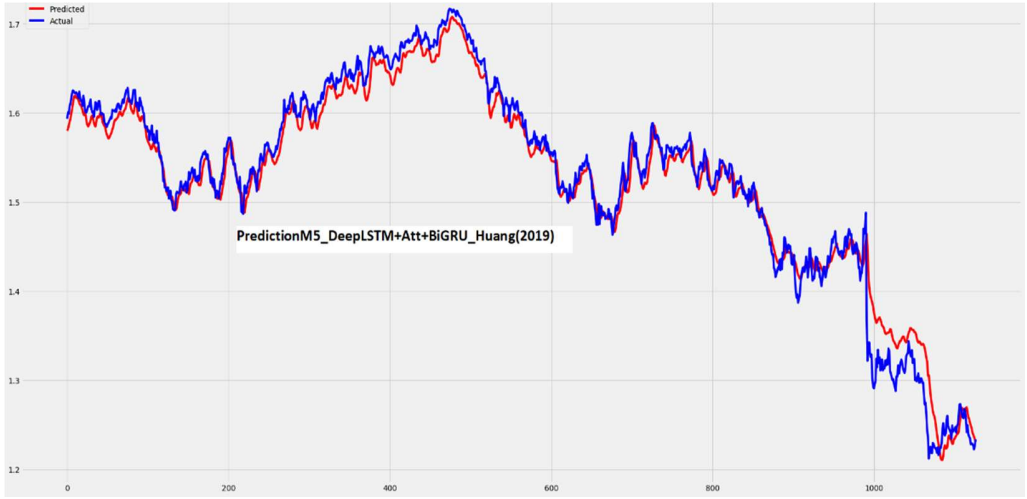

Figure 5 - LSTM(100)+Dropout(100)+Attention(SeqSelfAttention) + LSTM(16)+Dense(10) +Dense(10) + Dense(1) by Deep LSTM by Huang (2019)

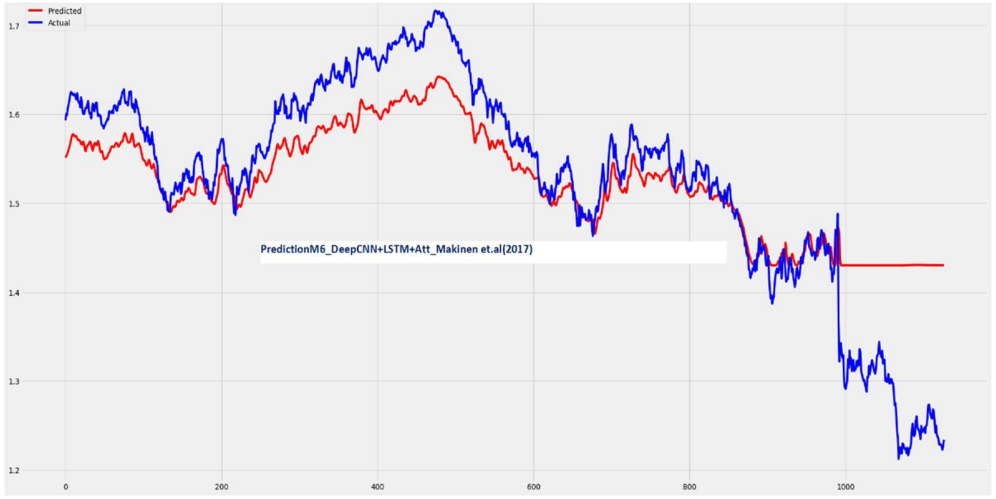

Figure 6 - LSTM(32)+Conv1D(32)+ Dropout(0.2) + Conv1D (16)+Conv1DTr(16)+Dropout(16)+ Conv1DTr(32)+Conv1D (16) + AttSeqSelf(1)+ LSTM(16)+Dropout(0.2)+Dense (1) by Makinen et. al (2017)SeqSelf(1)+LSTM(16)+Dropout(0.2)+Dense (1) by Huang (2019)ttention by Huang (2019)

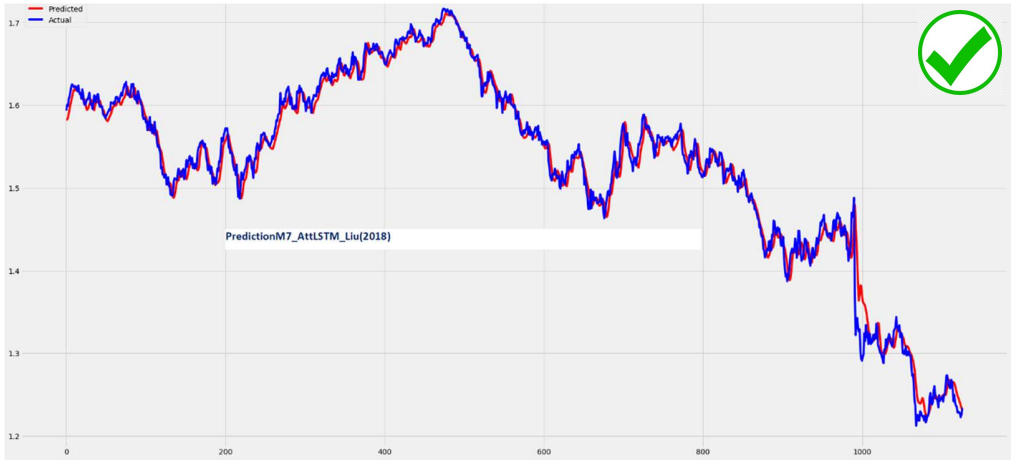

Figure 7 - LSTM(32)+Dropout(100)+Attention (SeqSelf (32))+LSTM (16)+Dense(10)+Dense(10)+Dense(1) by Liu (2018)

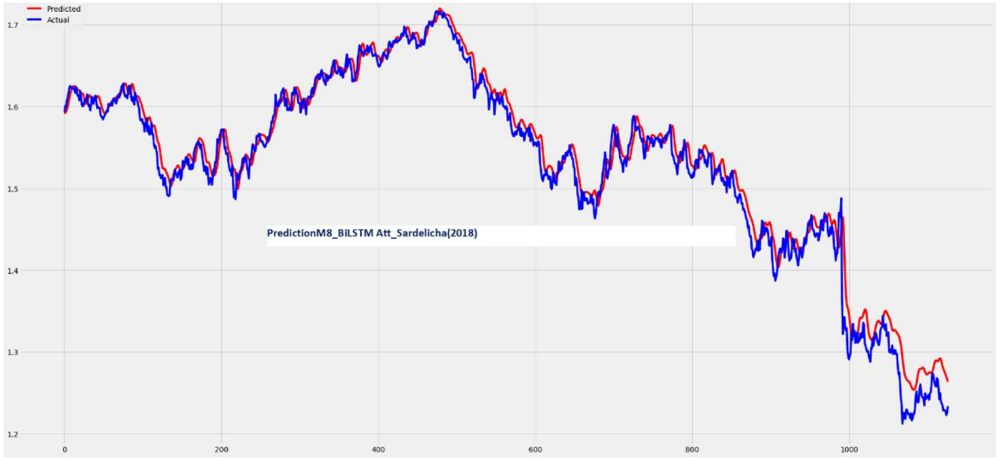

Figure 8 - LSTM(32)+Dropout(0.2)+ Attention (SeqSelf)(32) + Bidirection(LSTM(32))+ Bidirection(LSTM(32)) + Dense(10) + Dense(1) by by Sardelicha and Manandhara (2018)

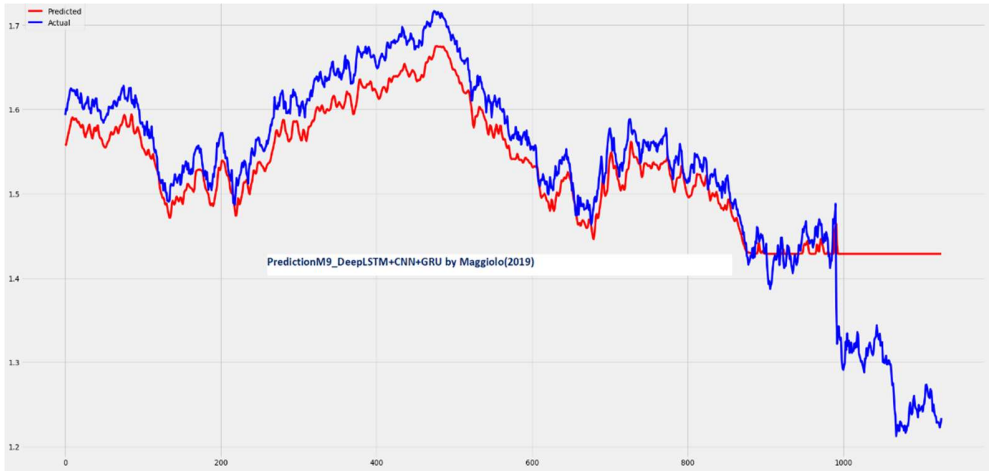

Figure 9 - LSTM(32)+ Conv1D(32)+ Dropout(0.2)+Conv1D(16)+ Conv1DTranspose(16)+ Dropout(0.2)+Conv1DTranspose(32)+Conv1DTranspose(1)+GRU(32)+Dropout(0.5)+Dense(1) by Maggiolo and Spanakis (2019)

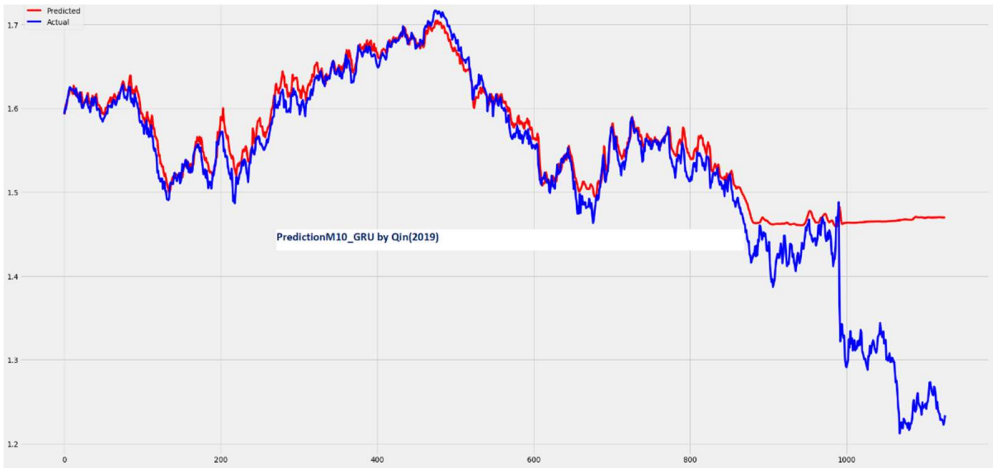

Figure 10 - GRU(32)+GRU(64)+Dropout(0.2)+GRU(128)+Dense(1) by GRU by Qin(2019)

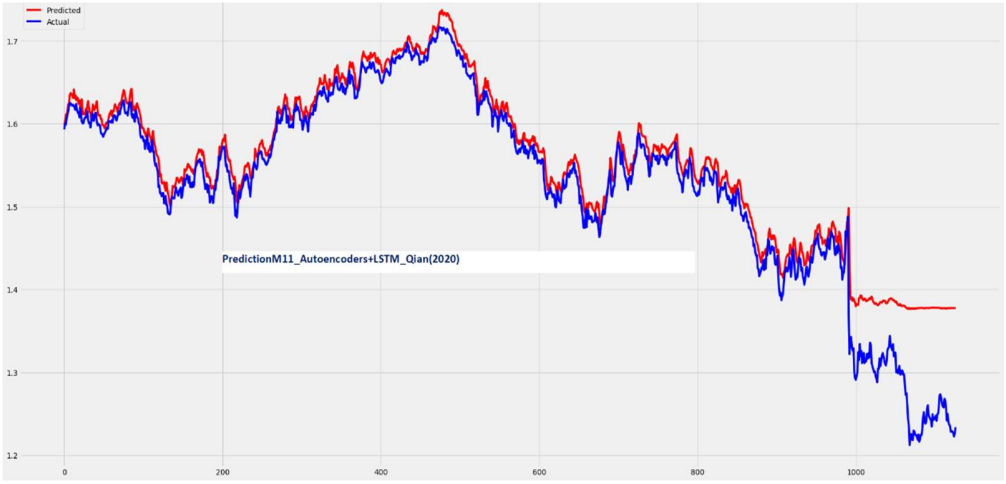

Figure 11- LSTM(32)+LSTM(64)+RepeatVector(64)+LSTM 64)+TimeDist(1)+ LSTM(128)+ Dropout128) + Dense(1 by Qian(2020)

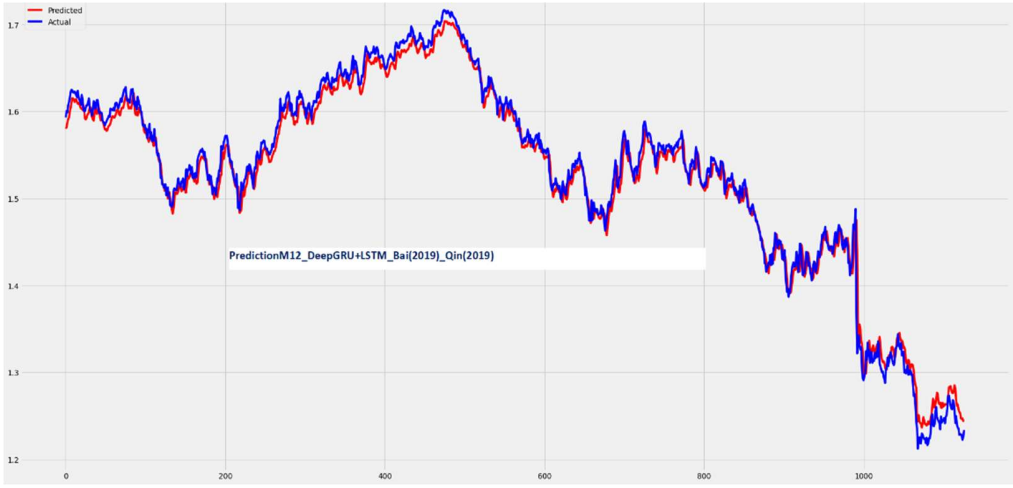

Figure 12 - LSTM(50)+Dropout+LSTM(100)+ Dropout (0.5)+ + GRU(100)+LSTM(100)+ Dropout (0.5)+ +LSTM(100)+ Dropout (0.5)+ Dense(100)+Dense(10)+Dense(10)+Dense(1) by Bai(2019) and Qin(2019)

SeLFISA_Model

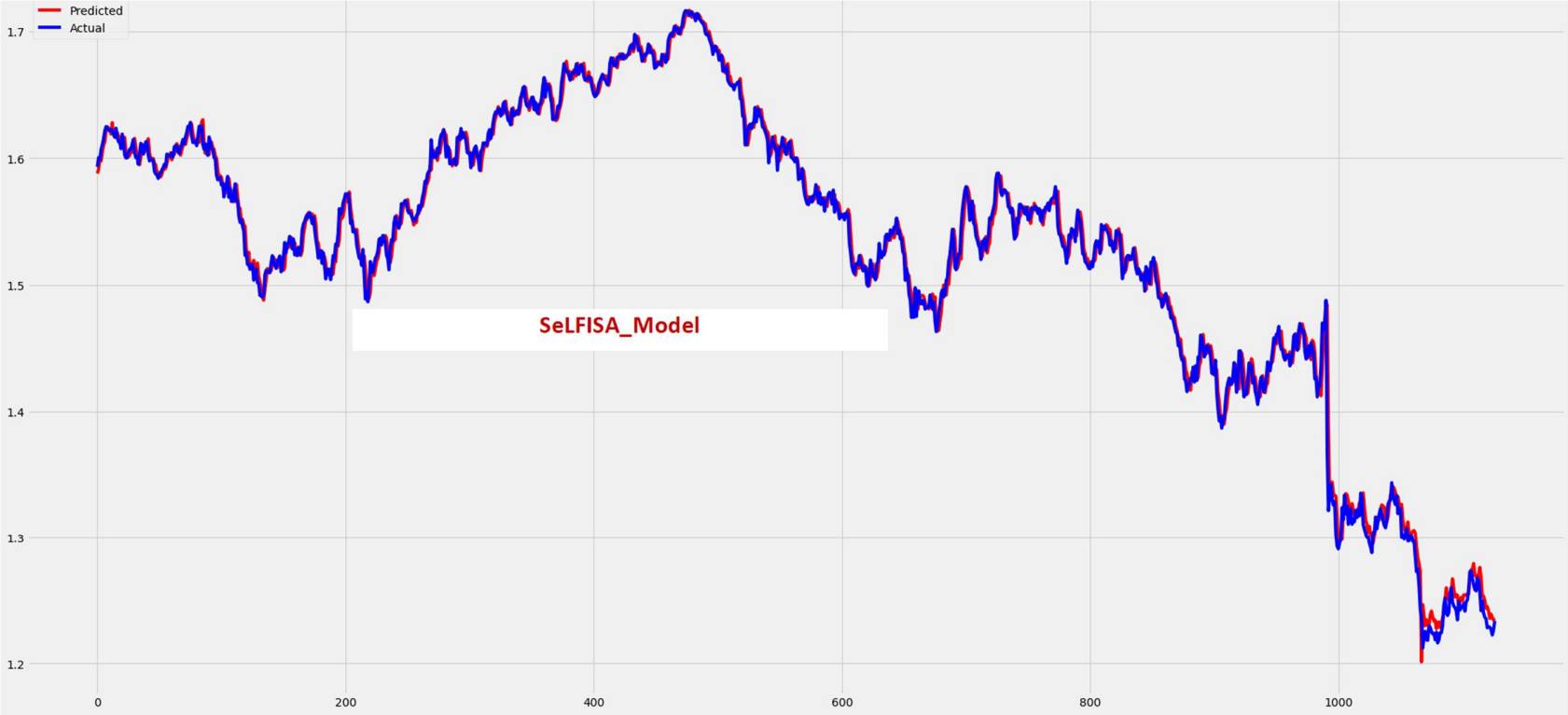

Figure 13 – BiD (GRU(32)) + SeqSelfAtt (att_width=30)+ Dropout(0.2) +BiD (LSTM(32)) +BiD (GRU(32))+ BiD (LSTM(32))+ BiD (GRU(32))+ LSTM (32)+ GRU (32) + Dense(1)