Chapter 12 : Part 4

**Deep Learning**

**RNN: GRU**

Variation of RNN

**12.4.1 GRU : Gated recurrent units**

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| * *Gated recurrent units (GRUs)* are a *gating mechanism* in RNN, introduced in 2014 by Kyunghyun Cho et al. The GRU is like a long short-term memory (LSTM) with a ***forget gate***, but has ***fewer parameters*** than ***LSTM***, as it lacks an ***output*** ***gate***. * GRU's performance on certain tasks of ***polyphonic*** ***music*** modeling, ***speech*** ***signal*** modeling and ***natural language processing (NLP)*** was found to be similar to that of LSTM. * Better for Smaller dataset: GRUs have been shown to exhibit better performance on certain smaller and less frequent datasets.[6][7] |  |

* There are several *variations* on the *full gated unit*, with *gating* done using the *previous* *hidden* *state* and the bias in *various* *combinations*, and a simplified form called *minimal gated unit*.
* The code is Exactly same, we just replace LSTM by GRU.

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| 100 epochs GRU, ADAM,  Epoch 1/100  38/38 [==============================] - 8s 65ms/step - loss: 0.0390  Epoch 2/100  38/38 [==============================] - 2s 65ms/step - loss: 0.0054  Epoch 3/100  38/38 [==============================] - 2s 65ms/step - loss: 0.0053  Epoch 4/100  38/38 [==============================] - 2s 65ms/step - loss: 0.0049  ---------------------- --------------------- ----------------------  Epoch 97/100  38/38 [==============================] - 3s 66ms/step - loss: 0.0013  Epoch 98/100  38/38 [==============================] - 3s 66ms/step - loss: 0.0013  Epoch 99/100  38/38 [==============================] - 2s 66ms/step - loss: 0.0015  Epoch 100/100  38/38 [==============================] - 2s 65ms/step - loss: 0.0014 | ------ Real Stock prices---------  [[778.81]  [788.36]  [786.08]  [795.26]  [806.4 ]  [807.86]  [805. ]  [807.14]  [807.48]  [807.08]  [805.81]  [805.12]  [806.91]  [807.25]  [822.3 ]  [829.62]  [837.81]  [834.71]  [814.66]  [796.86]] | ------ Predicted Stock prices---------  [[791.1578 ]  [789.262 ]  [793.8223 ]  [794.02014]  [797.9758 ]  [806.1135 ]  [809.07086]  [807.58527]  [809.06055]  [810.9257 ]  [811.3189 ]  [810.8287 ]  [810.64606]  [811.96246]  [812.74835]  [821.4289 ]  [828.5962 ]  [834.26086]  [834.3416 ]  [823.4504 ]] |

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| Epoch 1/100  38/38 [==============================] - 8s 64ms/step - loss: 0.0242  Epoch 2/100  38/38 [==============================] - 2s 64ms/step - loss: 0.0100  Epoch 3/100  38/38 [==============================] - 2s 64ms/step - loss: 0.0081  Epoch 4/100  38/38 [==============================] - 2s 64ms/step - loss: 0.0084  ----------------- --------------------- ---------------------  Epoch 96/100  38/38 [==============================] - 2s 64ms/step - loss: 0.0017  Epoch 97/100  38/38 [==============================] - 2s 64ms/step - loss: 0.0017  Epoch 98/100  38/38 [==============================] - 2s 65ms/step - loss: 0.0017  Epoch 99/100  38/38 [==============================] - 2s 65ms/step - loss: 0.0016  Epoch 100/100  38/38 [==============================] - 2s 64ms/step - loss: 0.0018 | ------ Real Stock prices---------  [[778.81]  [788.36]  [786.08]  [795.26]  [806.4 ]  [807.86]  [805. ]  [807.14]  [807.48]  [807.08]  [805.81]  [805.12]  [806.91]  [807.25]  [822.3 ]  [829.62]  [837.81]  [834.71]  [814.66]  [796.86]] | ------ Predicted Stock prices---------  [[795.52484]  [793.6181 ]  [800.1723 ]  [798.59094]  [804.2728 ]  [813.4076 ]  [814.29333]  [811.95935]  [814.19464]  [815.3559 ]  [815.036 ]  [814.4354 ]  [814.17615]  [815.6241 ]  [816.2212 ]  [827.5328 ]  [833.02094]  [838.3989 ]  [836.74066]  [823.7365 ]] |

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| ***10 epochs*** | ***100 epochs*** |
| Adam LSTM | Adam LSTM  C:\Users\SolLaSi\Downloads\imgs\RNN_google_stock.png |
| Adam GRU | Adam GRU  C:\Users\SolLaSi\Downloads\imgs\GRU_ADAm_100ep.png |
| Rmsprop GRU  C:\Users\SolLaSi\Downloads\imgs\GRU_rmsprop_10ep.png | Rmsprop GRU  C:\Users\SolLaSi\Downloads\imgs\GRU_rmsprop_100ep.png |