Bài 1) Kết quả của RNN





Bài 2) Kết quả của LSTM

Epoch 1: training: 100% | 179/179 [00:05<00:00, 35.67it/s] | 3166/3166 [00:04<00:00, 715.08it/s] evaluating: 100%| Accuracy: 0.523689197725837 Precision: 0.8242398284442268 Recall: 0.3495011851038472 F1: 0.25788909170321694 Epoch 2: training: 100% | 179/179 [00:03<00:00, 49.65it/s] evaluating: 100% 3166/3166 [00:05<00:00, 531.99it/s] Accuracy: 0.7618445988629186 Precision: 0.8628360957642726 Recall: 0.5415052678721546 F1: 0.5216193312768146 Epoch 3: training: 100% | 179/179 [00:03<00:00, 48.81it/s] evaluating: 100% | 3166/3166 [00:05<00:00, 589.59it/s] Accuracy: 0.7807959570435882 Precision: 0.8648377727212435 Recall: 0.5530605139467305 F1: 0.534961333569 Epoch 4: training: 100% | 179/179 [00:03<00:00, 46.09it/s] evaluating: 100%| | 3166/3166 [00:05<00:00, 544.05it/s] Accuracy: 0.8035375868603917 Precision: 0.8688073366424106 Recall: 0.5658657358431051 F1: 0.549902723407412 Epoch 5: training: 100% | 179/179 [00:03<00:00, 51.83it/s] evaluating: 100%| | 3166/3166 [00:07<00:00, 450.13it/s] Accuracy: 0.806380290587492 Precision: 0.8735979535134509 Recall: 0.5692606529155936 F1: 0.5521835004205596



Bài 3) Kết quả của GRU

```
Epoch 1:
                                                                              | 179/179 [00:06<00:00, 29.47it/s]
 training: 100%
                                                                             3166/3166 [00:05<00:00, 563.11it/s]
evaluating: 100%
Accuracy: 0.7684775742261529
Precision: 0.8458747718553283
Recall: 0.5413564789396705
F1: 0.5259360278579301
Epoch 2:
                                                                              | 179/179 [00:05<00:00, 33.63it/s]
training: 100%
evaluating: 100%
                                                                             3166/3166 [00:17<00:00, 176.74it/s]
Accuracy: 0.8297536323436513
Precision: 0.8863741786186573
Recall: 0.5845857641725178
F1: 0.5679604909802305
Epoch 3:
                                                                              | 179/179 [00:12<00:00, 14.63it/s]
training: 100%|
evaluating: 100%
                                                                           | 3166/3166 [00:06<00:00, 496.16it/s]
Accuracy: 0.8512318382817435
Precision: 0.90075705092801
Recall: 0.5998648996493045
F1: 0.5827159984012954
Epoch 4:
training: 100%|
                                                                              | 179/179 [00:05<00:00, 34.01it/s]
 evaluating: 100%
                                                                           | 3166/3166 [00:07<00:00, 423.82it/s]
Accuracy: 0.8603916614024005
Precision: 0.9076291237283551
Recall: 0.6068332805132624
F1: 0.5890509126742586
Epoch 5:
training: 100%|
                                                                              | 179/179 [00:05<00:00, 30.29it/s]
                                                                           | 3166/3166 [00:07<00:00, 449.91it/s]
evaluating: 100%
Accuracy: 0.8676563487049905
Precision: 0.911981901480615
Recall: 0.6116820142450524
F1: 0.5939946634113856
Epoch 6:
training: 100%
                                                                              | 179/179 [00:05<00:00, 32.10it/s]
evaluating: 100%
                                                                           | 3166/3166 [00:06<00:00, 460.60it/s]
Accuracy: 0.8704990524320909
Precision: 0.9140123053957344
Recall: 0.6138111838688991
F1: 0.5959628016118019
Epoch 7:
training: 100%
                                                                              | 179/179 [00:04<00:00, 37.28it/s]
evaluating: 100%
                                                                           | 3166/3166 [00:06<00:00, 485.52it/s]
Accuracy: 0.8774478837650032
Precision: 0.9180279832394383
Recall: 0.6181809660270231
F1: 0.6007213627342721
Epoch 8:
training: 100%|
                                                                              | 179/179 [00:08<00:00, 21.15it/s]
evaluating: 100%
                                                                           | 3166/3166 [00:17<00:00, 185.89it/s]
Accuracy: 0.8761844598862919
Precision: 0.9171443985479134
Recall: 0.6170461528389672
F1: 0.5998650342804068
Epoch 9:
training: 100%
                                                                              | 179/179 [00:05<00:00, 33.84it/s]
evaluating: 100%|
                                                                           | 3166/3166 [00:06<00:00, 502.12it/s]
Accuracy: 0.8796588755527479
Precision: 0.9202504485839915
Recall: 0.6202948103908239
F1: 0.6022261061217041
Epoch 10:
training: 100%|
                                                                              | 179/179 [00:05<00:00, 30.74it/s]
evaluating: 100%
                                                                           | 3166/3166 [00:07<00:00, 424.91it/s]
Accuracy: 0.8825015792798484
Precision: 0.7226411674189688
Recall: 0.6258620547870963
F1: 0.6119884113811037
```

Bài 4) Sử dụng pretrained embedding FastText

1) Đối với RNN

```
Epoch 1:
training: 100%
                                                                             | 179/179 [00:05<00:00, 30.17it/s]
                                                                           | 3166/3166 [00:07<00:00, 433.70it/s]
evaluating: 100%
C:\Users\VIET HOANG - VTS\Desktop\VisionReader\cuda\lib\site-packages\sklearn\metrics\ classification.py:1531: Un
definedMetricWarning: Precision is ill-defined and being set to 0.0 in labels with no predicted samples. Use `zer
o_division` parameter to control this behavior.
  _warn_prf(average, modifier, f"{metric.capitalize()} is", len(result))
Accuracy: 0.5022, Precision: 0.1674, Recall: 0.3333, F1: 0.2229
Epoch 2:
training: 100%
                                                                              | 179/179 [00:05<00:00, 34.58it/s]
evaluating: 100%
                                                                          | 3166/3166 [00:08<00:00, 386.69it/s]
C:\Users\VIET HOANG - VTS\Desktop\VisionReader\cuda\lib\site-packages\sklearn\metrics\_classification.py:1531: Un
definedMetricWarning: Precision is ill-defined and being set to 0.0 in labels with no predicted samples. Use `zer
o division` parameter to control this behavior.
  _warn_prf(average, modifier, f"{metric.capitalize()} is", len(result))
Accuracy: 0.4450, Precision: 0.1483, Recall: 0.3333, F1: 0.2053
Fnoch 3:
training: 100%
                                                                             | 179/179 [00:12<00:00, 14.86it/s]
evaluating: 100%
                                                                          | 3166/3166 [00:10<00:00, 308.12it/s]
C:\Users\VIET HOANG - VTS\Desktop\VisionReader\cuda\lib\site-packages\sklearn\metrics\_classification.py:1531: Un
definedMetricWarning: Precision is ill-defined and being set to 0.0 in labels with no predicted samples. Use `zer
o_division` parameter to control this behavior.
  _warn_prf(average, modifier, f"{metric.capitalize()} is", len(result))
Accuracy: 0.5022, Precision: 0.1674, Recall: 0.3333, F1: 0.2229
Epoch 4:
                                                                             | 179/179 [00:05<00:00, 34.46it/s]
training: 100%
evaluating: 100%
                                                                           | 3166/3166 [00:06<00:00, 476.01it/s]
C:\Users\VIET HOANG - VTS\Desktop\VisionReader\cuda\lib\site-packages\sklearn\metrics\_classification.py:1531: Un
definedMetricWarning: Precision is ill-defined and being set to 0.0 in labels with no predicted samples. Use `zer
o division` parameter to control this behavior.
  _warn_prf(average, modifier, f"{metric.capitalize()} is", len(result))
Accuracy: 0.5022, Precision: 0.1674, Recall: 0.3333, F1: 0.2229
```

```
Epoch 5:
training: 100%
                                                                                                                              | 179/179 [00:05<00:00, 34.00it/s]
evaluating: 100%
                                                                                                                         | 3166/3166 [00:06<00:00, 452.97it/s]
C:\Users\VIET HOANG - VTS\Desktop\VisionReader\cuda\lib\site-packages\sklearn\metrics\ classification.py:1531: Un
definedMetricWarning: Precision is ill-defined and being set to 0.0 in labels with no predicted samples. Use `zer
o_division` parameter to control this behavior.
    _warn_prf(average, modifier, f"{metric.capitalize()} is", len(result))
Accuracy: 0.5022, Precision: 0.1674, Recall: 0.3333, F1: 0.2229
Epoch 6:
                                                                                                                              | 179/179 [00:05<00:00, 31.64it/s]
training: 100%
evaluating: 100%|
                                                                                                                         | 3166/3166 [00:07<00:00, 424.86it/s]
C:\Users\VIET HOANG - VTS\Desktop\VisionReader\cuda\lib\site-packages\sklearn\metrics\ classification.py:1531: Un
definedMetricWarning: Precision is ill-defined and being set to 0.0 in labels with no predicted samples. Use `zer
o division` parameter to control this behavior.
    _warn_prf(average, modifier, f"{metric.capitalize()} is", len(result))
Accuracy: 0.5022, Precision: 0.1674, Recall: 0.3333, F1: 0.2229
Fnoch 7:
training: 100%
                                                                                                                              | 179/179 [00:05<00:00, 33.90it/s]
                                                                                                                         | 3166/3166 [00:08<00:00, 392.06it/s]
evaluating: 100%
C:\Users\VIET HOANG - VTS\Desktop\VisionReader\cuda\lib\site-packages\sklearn\metrics\_classification.py:1531: Un
definedMetricWarning: Precision is ill-defined and being set to 0.0 in labels with no predicted samples. Use `zer
o_division` parameter to control this behavior.
   _warn_prf(average, modifier, f"{metric.capitalize()} is", len(result))
Accuracy: 0.5022, Precision: 0.1674, Recall: 0.3333, F1: 0.2229
Epoch 8:
training: 100%
                                                                                                                              | 179/179 [00:05<00:00, 33.57it/s]
                                                                                                                         | 3166/3166 [00:06<00:00, 470.41it/s]
evaluating: 100%
C:\Users\VIET HOANG - VTS\Desktop\VisionReader\cuda\lib\site-packages\sklearn\metrics\ classification.py:1531: Un
definedMetricWarning: Precision is ill-defined and being set to 0.0 in labels with no predicted samples. Use `zer
o_division` parameter to control this behavior.
   _warn_prf(average, modifier, f"{metric.capitalize()} is", len(result))
Accuracy: 0.4450, Precision: 0.1483, Recall: 0.3333, F1: 0.2053
Epoch 9:
training: 100%
                                                                                                                             | 179/179 [00:05<00:00, 34.18it/s]
evaluating: 100%
                                                                                                                        | 3166/3166 [00:07<00:00, 429.70it/s]
C:\Users\VIET HOANG - VTS\Desktop\VisionReader\cuda\lib\site-packages\sklearn\metrics\_classification.py:1531: Un
definedMetricWarning: Precision is ill-defined and being set to 0.0 in labels with no predicted samples. Use `zer
o division` parameter to control this behavior.
   _warn_prf(average, modifier, f"{metric.capitalize()} is", len(result))
Accuracy: 0.5022, Precision: 0.1674, Recall: 0.3333, F1: 0.2229
Epoch 10:
training: 100%
                                                                                                                             | 179/179 [00:05<00:00, 33.92it/s]
evaluating: 100%
                                                                                                                        | 3166/3166 [00:06<00:00, 468.27it/s]
 \hbox{C:\Users\VIET HOANG - VTS\Desktop\VisionReader\cuda\lib\site-packages\sklearn\mbox{metrics\classification.py:1531: UnionStates and the control of the c
definedMetricWarning: Precision is ill-defined and being set to 0.0 in labels with no predicted samples. Use `zer
o division` parameter to control this behavior.
   _warn_prf(average, modifier, f"{metric.capitalize()} is", len(result))
Accuracy: 0.5022, Precision: 0.1674, Recall: 0.3333, F1: 0.2229
```

2) Đối với LSTM

```
Epoch 1:
training: 100%
                                                                           | 179/179 [00:07<00:00, 23.04it/s]
evaluating: 100%
                                                                         | 3166/3166 [00:08<00:00, 388.33it/s]
C:\Users\VIET HOANG - VTS\Desktop\VisionReader\cuda\lib\site-packages\sklearn\metrics\ classification.py:1531: Un
definedMetricWarning: Precision is ill-defined and being set to 0.0 in labels with no predicted samples. Use `zer
o_division` parameter to control this behavior.
  warn prf(average, modifier, f"{metric.capitalize()} is", len(result))
Accuracy: 0.6317, Precision: 0.4424, Recall: 0.4354, F1: 0.4165
Epoch 2:
training: 100%
                                                                           | 179/179 [00:05<00:00, 34.66it/s]
evaluating: 100%
                                                                         | 3166/3166 [00:08<00:00, 378.10it/s]
C:\Users\VIET HOANG - VTS\Desktop\VisionReader\cuda\lib\site-packages\sklearn\metrics\ classification.py:1531: Un
definedMetricWarning: Precision is ill-defined and being set to 0.0 in labels with no predicted samples. Use `zer
o_division` parameter to control this behavior.
  _warn_prf(average, modifier, f"{metric.capitalize()} is", len(result))
Accuracy: 0.7836, Precision: 0.5241, Recall: 0.5531, F1: 0.5366
Epoch 3:
training: 100%
                                                                           | 179/179 [00:05<00:00, 35.77it/s]
                                                                         | 3166/3166 [00:07<00:00, 414.45it/s]
evaluating: 100%
C:\Users\VIET HOANG - VTS\Desktop\VisionReader\cuda\lib\site-packages\sklearn\metrics\_classification.py:1531: Un
definedMetricWarning: Precision is ill-defined and being set to 0.0 in labels with no predicted samples. Use `zer
o_division` parameter to control this behavior.
  _warn_prf(average, modifier, f"{metric.capitalize()} is", len(result))
Accuracy: 0.8004, Precision: 0.5331, Recall: 0.5632, F1: 0.5477
Epoch 4:
training: 100%
                                                                           | 179/179 [00:05<00:00, 33.48it/s]
                                                                         | 3166/3166 [00:08<00:00, 386.50it/s]
evaluating: 100%
C:\Users\VIET HOANG - VTS\Desktop\VisionReader\cuda\lib\site-packages\sklearn\metrics\ classification.py:1531: Un
definedMetricWarning: Precision is ill-defined and being set to 0.0 in labels with no predicted samples. Use `zer
o division` parameter to control this behavior.
  _warn_prf(average, modifier, f"{metric.capitalize()} is", len(result))
Accuracy: 0.7972, Precision: 0.5353, Recall: 0.5634, F1: 0.5460
 Epoch 5:
 training: 100%
                                                                             | 179/179 [00:04<00:00, 35.92it/s]
 evaluating: 100%
                                                                          | 3166/3166 [00:08<00:00, 383.55it/s]
 C:\Users\VIET HOANG - VTS\Desktop\VisionReader\cuda\lib\site-packages\sklearn\metrics\ classification.py:1531: Ur
 definedMetricWarning: Precision is ill-defined and being set to 0.0 in labels with no predicted samples. Use `zer
 o_division` parameter to control this behavior.
   _warn_prf(average, modifier, f"{metric.capitalize()} is", len(result))
 Accuracy: 0.8215, Precision: 0.5472, Recall: 0.5783, F1: 0.5622
 Epoch 6:
 training: 100%
                                                                            | 179/179 [00:05<00:00, 34.03it/s]
 evaluating: 100%
                                                                          | 3166/3166 [00:07<00:00, 416.87it/s]
 definedMetricWarning: Precision is ill-defined and being set to 0.0 in labels with no predicted samples. Use `zer
 o_division` parameter to control this behavior.
   warn prf(average, modifier, f"{metric.capitalize()} is", len(result))
 Accuracy: 0.8231, Precision: 0.5483, Recall: 0.5789, F1: 0.5632
 Epoch 7:
 training: 100%
                                                                            | 179/179 [00:05<00:00, 32.28it/s]
 evaluating: 100%|
                                                                          | 3166/3166 [00:08<00:00, 386.98it/s]
 C:\Users\VIET HOANG - VTS\Desktop\VisionReader\cuda\lib\site-packages\sklearn\metrics\ classification.py:1531: Ur
 definedMetricWarning: Precision is ill-defined and being set to 0.0 in labels with no predicted samples. Use `zer
 o division` parameter to control this behavior.
   warn prf(average, modifier, f"{metric.capitalize()} is", len(result))
 Accuracy: 0.8165, Precision: 0.5460, Recall: 0.5725, F1: 0.5580
 Epoch 8:
 training: 100%
                                                                            | 179/179 [00:05<00:00, 35.60it/s]
 evaluating: 100%
                                                                          | 3166/3166 [00:07<00:00, 418.79it/s]
 C:\Users\VIET HOANG - VTS\Desktop\VisionReader\cuda\lib\site-packages\sklearn\metrics\_classification.py:1531: Ur
 definedMetricWarning: Precision is ill-defined and being set to 0.0 in labels with no predicted samples. Use `zer
 o_division` parameter to control this behavior.
   _warn_prf(average, modifier, f"{metric.capitalize()} is", len(result))
 Accuracy: 0.8241, Precision: 0.5513, Recall: 0.5781, F1: 0.5635
```

```
Epoch 9:
training: 100%
                                                                             | 179/179 [00:05<00:00, 34.42it/s]
evaluating: 100%
                                                                          | 3166/3166 [00:08<00:00, 379.12it/s]
C:\Users\VIET HOANG - VTS\Desktop\VisionReader\cuda\lib\site-packages\sklearn\metrics\_classification.py:1531: Un
definedMetricWarning: Precision is ill-defined and being set to 0.0 in labels with no predicted samples. Use `zer
o_division` parameter to control this behavior.
  _warn_prf(average, modifier, f"{metric.capitalize()} is", len(result))
Accuracy: 0.8329, Precision: 0.5563, Recall: 0.5874, F1: 0.5702
Epoch 10:
training: 100%
                                                                             | 179/179 [00:05<00:00, 35.23it/s]
evaluating: 100%
                                                                          | 3166/3166 [00:08<00:00, 387.70it/s]
Accuracy: 0.8380, Precision: 0.7492, Recall: 0.5963, F1: 0.5884
```

3) Đối với GRU

```
Epoch 1:
                                                                             | 179/179 [00:07<00:00, 23.79it/s]
training: 100%
                                                                          | 3166/3166 [00:07<00:00, 415.95it/s]
evaluating: 100%
C:\Users\VIET HOANG - VTS\Desktop\VisionReader\cuda\lib\site-packages\sklearn\metrics\_classification.py:1531: Un
definedMetricWarning: Precision is ill-defined and being set to 0.0 in labels with no predicted samples. Use `zer
o_division` parameter to control this behavior.
  _warn_prf(average, modifier, f"{metric.capitalize()} is", len(result))
Accuracy: 0.7543, Precision: 0.5036, Recall: 0.5320, F1: 0.5164
Epoch 2:
                                                                             | 179/179 [00:05<00:00, 30.34it/s]
training: 100%
evaluating: 100%
                                                                          | 3166/3166 [00:08<00:00, 385.15it/s]
C:\Users\VIET HOANG - VTS\Desktop\VisionReader\cuda\lib\site-packages\sklearn\metrics\_classification.py:1531: Un
definedMetricWarning: Precision is ill-defined and being set to 0.0 in labels with no predicted samples. Use `zer
o_division` parameter to control this behavior.
  _warn_prf(average, modifier, f"{metric.capitalize()} is", len(result))
Accuracy: 0.8004, Precision: 0.5349, Recall: 0.5646, F1: 0.5480
Epoch 3:
training: 100%
                                                                             | 179/179 [00:05<00:00, 30.61it/s]
evaluating: 100%
                                                                          | 3166/3166 [00:08<00:00, 367.01it/s]
C:\Users\VIET HOANG - VTS\Desktop\VisionReader\cuda\lib\site-packages\sklearn\metrics\ classification.py:1531: Un
definedMetricWarning: Precision is ill-defined and being set to 0.0 in labels with no predicted samples. Use `zer
o_division` parameter to control this behavior.
  _warn_prf(average, modifier, f"{metric.capitalize()} is", len(result))
Accuracy: 0.8155, Precision: 0.5441, Recall: 0.5749, F1: 0.5583
Epoch 4:
training: 100%
                                                                             | 179/179 [00:05<00:00, 31.77it/s]
evaluating: 100%
                                                                          | 3166/3166 [00:07<00:00, 430.72it/s]
C:\Users\VIET HOANG - VTS\Desktop\VisionReader\cuda\lib\site-packages\sklearn\metrics\ classification.py:1531: Un
definedMetricWarning: Precision is ill-defined and being set to 0.0 in labels with no predicted samples. Use `zer
o_division` parameter to control this behavior.
  _warn_prf(average, modifier, f"{metric.capitalize()} is", len(result))
Accuracy: 0.8193, Precision: 0.5493, Recall: 0.5785, F1: 0.5611
```

Epoch 5: training: 100% evaluating: 100% Accuracy: 0.8332,		0.7461,	Recall:	0.5940,	F1:	0.5854	П	179/179 [00:05<00:00, 32.11it/s] 3166/3166 [00:08<00:00, 364.95it/s]
training: 100% evaluating: 100% Accuracy: 0.8316,		0.7549,	Recall:	0.6065,	F1:	0.6111		179/179 [00:05<00:00, 31.72it/s] 3166/3166 [00:07<00:00, 407.65it/s]
Epoch 7: training: 100% evaluating: 100%								179/179 [00:05<00:00, 33.60it/s] 3166/3166 [00:07<00:00, 409.23it/s]
Accuracy: 0.8468, Epoch 8: training: 100%		0.7542,	Recall:	0.6376,	F1:	0.6523	П	179/179 [00:05<00:00, 34.52it/s] 3166/3166 [00:07<00:00, 430.50it/s]
Accuracy: 0.8490, Epoch 9: training: 100%		0.7420,	Recall:	0.6578,	F1:	0.6772		179/179 [00:05<00:00, 33.35it/s]
evaluating: 100% Accuracy: 0.8487, Epoch 10:		0.7313,	Recall:	0.6484,	F1:	0.6653		3166/3166 [00:07<00:00, 413.69it/s]
training: 100% evaluating: 100% Accuracy: 0.8522,	Precision:	0.7281,	Recall:	0.6684,	F1:	0.6859		179/179 [00:05<00:00, 35.08it/s] 3166/3166 [00:07<00:00, 432.39it/s]