新闻主题分类--基于 Pytorch

姓名	专业	学号	角色	备注
袁秋凰	计算机应用技术	221017000199		一人完成

一、项目描述

基于 pytorch 构建 2 种神经网络，TextCNN，TextRNN，对 THUCNews 中的新闻主题进行分类，2 种网络结构分类结果进行对比。

二、数据集说明

从 THUCNews 中获取了几十万条新闻标题，重新整合

划分为 10 个类别：finance、realty、stocks、education、science、society、politics、sports、game、entertainment。

数据集为 txt 格式，分为训练集（十几万条）、验证集、测试集。

三、模型训练以及验证

模型　　准确率　备注

TextRNN　90.86%

TextCNN　91.36%

3.1　RNN 网络训练过程

```
Epoch [1/10]
Iter:      0,  Train Loss:   2.3,  Train Acc: 10.94%,  Val Loss:   2.3,  Val Acc: 11.94%,  Time: 0:00:13 *
Iter:    100,  Train Loss:   1.7,  Train Acc: 41.41%,  Val Loss:   1.6,  Val Acc: 40.40%,  Time: 0:01:12 *
```

```
Iter:    200,  Train Loss:   1.3,  Train Acc: 53.91%,  Val Loss:   1.2,  Val Acc: 56.55%,  Time: 0:02:13 *
Iter:    300,  Train Loss:  0.86,  Train Acc: 69.53%,  Val Loss:  0.93,  Val Acc: 68.89%,  Time: 0:03:16 *
Iter:    400,  Train Loss:  0.67,  Train Acc: 78.12%,  Val Loss:  0.73,  Val Acc: 75.81%,  Time: 0:04:23 *
Iter:    500,  Train Loss:  0.59,  Train Acc: 80.47%,  Val Loss:  0.63,  Val Acc: 78.75%,  Time: 0:05:16 *
Iter:    600,  Train Loss:  0.55,  Train Acc: 82.03%,  Val Loss:  0.55,  Val Acc: 82.43%,  Time: 0:06:17 *
Iter:    700,  Train Loss:  0.55,  Train Acc: 79.69%,  Val Loss:  0.52,  Val Acc: 83.48%,  Time: 0:07:54 *
Iter:    800,  Train Loss:  0.48,  Train Acc: 86.72%,  Val Loss:  0.51,  Val Acc: 83.88%,  Time: 0:09:14 *
Iter:    900,  Train Loss:   0.5,  Train Acc: 82.81%,  Val Loss:  0.46,  Val Acc: 85.49%,  Time: 0:10:11 *
Iter:   1000,  Train Loss:  0.32,  Train Acc: 89.06%,  Val Loss:  0.44,  Val Acc: 86.05%,  Time: 0:11:04 *
Iter:   1100,  Train Loss:  0.32,  Train Acc: 91.41%,  Val Loss:  0.43,  Val Acc: 86.61%,  Time: 0:11:55 *
Iter:   1200,  Train Loss:  0.37,  Train Acc: 87.50%,  Val Loss:  0.42,  Val Acc: 87.10%,  Time: 0:12:48 *
Iter:   1300,  Train Loss:  0.47,  Train Acc: 85.94%,  Val Loss:  0.43,  Val Acc: 86.77%,  Time: 0:13:44
Iter:   1400,  Train Loss:  0.48,  Train Acc: 85.94%,  Val Loss:   0.4,  Val Acc: 87.34%,  Time: 0:14:43 *
Epoch [2/10]
Iter:   1500,  Train Loss:  0.41,  Train Acc: 87.50%,  Val Loss:  0.39,  Val Acc: 87.65%,  Time: 0:15:48 *
Iter:   1600,  Train Loss:  0.39,  Train Acc: 85.16%,  Val Loss:  0.39,  Val Acc: 87.80%,  Time: 0:16:40
Iter:   1700,  Train Loss:  0.39,  Train Acc: 85.94%,  Val Loss:  0.38,  Val Acc: 88.10%,  Time: 0:17:30 *
Iter:   1800,  Train Loss:  0.28,  Train Acc: 89.84%,  Val Loss:  0.38,  Val Acc: 88.27%,  Time: 0:18:21 *
Iter:   1900,  Train Loss:  0.34,  Train Acc: 89.84%,  Val Loss:  0.35,  Val Acc: 88.86%,  Time: 0:19:20 *
Iter:   2000,  Train Loss:  0.38,  Train Acc: 87.50%,  Val Loss:  0.35,  Val Acc: 88.83%,  Time: 0:20:27
Iter:   2100,  Train Loss:  0.35,  Train Acc: 89.84%,  Val Loss:  0.35,  Val Acc: 88.84%,  Time: 0:21:33
Iter:   2200,  Train Loss:  0.21,  Train Acc: 92.97%,  Val Loss:  0.35,  Val Acc: 89.18%,  Time: 0:22:34
Iter:   2300,  Train Loss:  0.27,  Train Acc: 92.19%,  Val Loss:  0.33,  Val Acc: 89.30%,  Time: 0:23:37 *
Iter:   2400,  Train Loss:  0.32,  Train Acc: 89.06%,  Val Loss:  0.36,  Val Acc: 88.59%,  Time: 0:24:36
Iter:   2500,  Train Loss:  0.22,  Train Acc: 92.97%,  Val Loss:  0.34,  Val Acc: 89.45%,  Time: 0:25:35
Iter:   2600,  Train Loss:  0.38,  Train Acc: 89.06%,  Val Loss:  0.35,  Val Acc: 89.07%,  Time: 0:27:07
Iter:   2700,  Train Loss:   0.3,  Train Acc: 92.97%,  Val Loss:  0.33,  Val Acc: 89.02%,  Time: 0:28:36 *
Iter:   2800,  Train Loss:  0.43,  Train Acc: 87.50%,  Val Loss:  0.35,  Val Acc: 89.24%,  Time: 0:29:58
Epoch [3/10]
Iter:   2900,  Train Loss:  0.36,  Train Acc: 90.62%,  Val Loss:  0.32,  Val Acc: 89.77%,  Time: 0:31:24 *
Iter:   3000,  Train Loss:  0.26,  Train Acc: 89.84%,  Val Loss:  0.33,  Val Acc: 89.88%,  Time: 0:32:33
Iter:   3100,  Train Loss:  0.23,  Train Acc: 92.19%,  Val Loss:  0.34,  Val Acc: 89.39%,  Time: 0:33:40
Iter:   3200,  Train Loss:  0.33,  Train Acc: 92.97%,  Val Loss:  0.33,  Val Acc: 89.38%,  Time: 0:34:29
Iter:   3300,  Train Loss:  0.27,  Train Acc: 90.62%,  Val Loss:  0.32,  Val Acc: 89.80%,  Time: 0:35:20 *
Iter:   3400,  Train Loss:  0.28,  Train Acc: 91.41%,  Val Loss:  0.33,  Val Acc: 89.72%,  Time: 0:36:09
Iter:   3500,  Train Loss:  0.23,  Train Acc: 92.19%,  Val Loss:  0.34,  Val Acc: 89.15%,  Time: 0:36:58
Iter:   3600,  Train Loss:  0.19,  Train Acc: 94.53%,  Val Loss:  0.32,  Val Acc: 90.26%,  Time: 0:37:50
Iter:   3700,  Train Loss:  0.34,  Train Acc: 89.06%,  Val Loss:  0.31,  Val Acc: 90.11%,  Time: 0:38:40 *
Iter:   3800,  Train Loss:  0.29,  Train Acc: 89.84%,  Val Loss:  0.32,  Val Acc: 90.01%,  Time: 0:39:37
Iter:   3900,  Train Loss:  0.25,  Train Acc: 90.62%,  Val Loss:  0.31,  Val Acc: 90.17%,  Time: 0:40:33
Iter:   4000,  Train Loss:  0.22,  Train Acc: 92.97%,  Val Loss:  0.33,  Val Acc: 89.63%,  Time: 0:41:24
Iter:   4100,  Train Loss:  0.25,  Train Acc: 92.19%,  Val Loss:  0.31,  Val Acc: 90.14%,  Time: 0:42:26
Iter:   4200,  Train Loss:  0.27,  Train Acc: 92.19%,  Val Loss:  0.32,  Val Acc: 90.11%,  Time: 0:43:42
Epoch [4/10]
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Iter:   4300,  Train Loss:  0.22,  Train Acc: 92.97%,  Val Loss:  0.31,  Val Acc: 90.11%,  Time: 0:44:37
Iter:   4400,  Train Loss:  0.11,  Train Acc: 97.66%,  Val Loss:  0.31,  Val Acc: 90.29%,  Time: 0:45:32 *
Iter:   4500,  Train Loss:  0.26,  Train Acc: 92.19%,  Val Loss:  0.31,  Val Acc: 90.35%,  Time: 0:46:43
Iter:   4600,  Train Loss:   0.2,  Train Acc: 92.97%,  Val Loss:  0.31,  Val Acc: 90.15%,  Time: 0:47:45
Iter:   4700,  Train Loss:  0.29,  Train Acc: 91.41%,  Val Loss:   0.3,  Val Acc: 90.40%,  Time: 0:48:36 *
Iter:   4800,  Train Loss:  0.14,  Train Acc: 96.09%,  Val Loss:   0.3,  Val Acc: 90.55%,  Time: 0:49:24 *
Iter:   4900,  Train Loss:   0.2,  Train Acc: 93.75%,  Val Loss:  0.31,  Val Acc: 90.50%,  Time: 0:50:11
Iter:   5000,  Train Loss:  0.19,  Train Acc: 93.75%,  Val Loss:  0.32,  Val Acc: 90.17%,  Time: 0:51:00
Iter:   5100,  Train Loss:  0.21,  Train Acc: 92.97%,  Val Loss:   0.3,  Val Acc: 90.44%,  Time: 0:51:46
Iter:   5200,  Train Loss:  0.35,  Train Acc: 89.06%,  Val Loss:  0.31,  Val Acc: 90.55%,  Time: 0:52:33
Iter:   5300,  Train Loss:  0.18,  Train Acc: 94.53%,  Val Loss:  0.32,  Val Acc: 90.26%,  Time: 0:53:20
Iter:   5400,  Train Loss:  0.35,  Train Acc: 88.28%,  Val Loss:  0.32,  Val Acc: 90.42%,  Time: 0:54:11
Iter:   5500,  Train Loss:  0.18,  Train Acc: 92.97%,  Val Loss:  0.31,  Val Acc: 90.18%,  Time: 0:55:15
Iter:   5600,  Train Loss:  0.16,  Train Acc: 92.97%,  Val Loss:   0.3,  Val Acc: 90.53%,  Time: 0:56:17
Epoch [5/10]
Iter:   5700,  Train Loss:  0.27,  Train Acc: 91.41%,  Val Loss:   0.3,  Val Acc: 90.99%,  Time: 0:57:19 *
Iter:   5800,  Train Loss:  0.12,  Train Acc: 96.88%,  Val Loss:  0.32,  Val Acc: 90.20%,  Time: 0:58:07
Iter:   5900,  Train Loss:  0.14,  Train Acc: 95.31%,  Val Loss:  0.32,  Val Acc: 90.35%,  Time: 0:59:12
Iter:   6000,  Train Loss:  0.21,  Train Acc: 92.97%,  Val Loss:   0.3,  Val Acc: 90.59%,  Time: 1:00:03
Iter:   6100,  Train Loss:  0.32,  Train Acc: 91.41%,  Val Loss:   0.3,  Val Acc: 90.87%,  Time: 1:00:54
Iter:   6200,  Train Loss: 0.083,  Train Acc: 97.66%,  Val Loss:  0.32,  Val Acc: 90.55%,  Time: 1:01:45
Iter:   6300,  Train Loss:  0.13,  Train Acc: 96.09%,  Val Loss:   0.3,  Val Acc: 90.72%,  Time: 1:02:36
Iter:   6400,  Train Loss: 0.089,  Train Acc: 96.09%,  Val Loss:  0.31,  Val Acc: 90.91%,  Time: 1:03:29
Iter:   6500,  Train Loss:  0.32,  Train Acc: 89.84%,  Val Loss:   0.3,  Val Acc: 91.04%,  Time: 1:04:25 *
Iter:   6600,  Train Loss:  0.16,  Train Acc: 94.53%,  Val Loss:  0.32,  Val Acc: 90.45%,  Time: 1:05:30
Iter:   6700,  Train Loss:  0.13,  Train Acc: 93.75%,  Val Loss:  0.31,  Val Acc: 90.84%,  Time: 1:06:21
Iter:   6800,  Train Loss:  0.15,  Train Acc: 95.31%,  Val Loss:  0.33,  Val Acc: 90.48%,  Time: 1:07:08
Iter:   6900,  Train Loss: 0.097,  Train Acc: 96.09%,  Val Loss:   0.3,  Val Acc: 90.97%,  Time: 1:07:56
Iter:   7000,  Train Loss:  0.17,  Train Acc: 92.19%,  Val Loss:  0.32,  Val Acc: 90.38%,  Time: 1:08:49
Epoch [6/10]
Iter:   7100,  Train Loss:  0.16,  Train Acc: 93.75%,  Val Loss:  0.32,  Val Acc: 90.74%,  Time: 1:09:44
Iter:   7200,  Train Loss:  0.24,  Train Acc: 92.97%,  Val Loss:  0.33,  Val Acc: 90.42%,  Time: 1:10:43
Iter:   7300,  Train Loss:  0.12,  Train Acc: 95.31%,  Val Loss:  0.31,  Val Acc: 90.92%,  Time: 1:11:40
Iter:   7400,  Train Loss:  0.13,  Train Acc: 96.09%,  Val Loss:   0.3,  Val Acc: 90.95%,  Time: 1:12:35
Iter:   7500,  Train Loss: 0.086,  Train Acc: 98.44%,  Val Loss:  0.32,  Val Acc: 90.83%,  Time: 1:13:28
No optimization for a long time, auto-stopping...
Test Loss:  0.31,  Test Acc: 90.86%
Precision, Recall and F1-Score...
              precision    recall  f1-score   support

       finance     0.9051     0.8970     0.9011       1000
        realty     0.9332     0.9220     0.9276       1000
        stocks     0.8789     0.8130     0.8447       1000
     education     0.9503     0.9360     0.9431       1000
```

```
       science     0.8139    0.8790    0.8452      1000
       society     0.8952    0.9230    0.9089      1000
      politics     0.8931    0.8770    0.8850      1000
        sports     0.9887    0.9590    0.9736      1000
          game     0.9193    0.9340    0.9266      1000
entertainment     0.9167    0.9460    0.9311      1000

      accuracy                         0.9086     10000
     macro avg     0.9094    0.9086    0.9087     10000
  weighted avg     0.9094    0.9086    0.9087     10000

Confusion Matrix...
[[897  15  39   4  22   8   7   2   2   4]
 [ 11 922  20   0   9  17   4   0   5  12]
 [ 62  21 813   4  59   2  29   1   7   2]
 [  1   3   1 936  11  18  10   1   7  12]
 [  3   3  21   8 879  20  18   1  32  15]
 [  0  13   1  14   9 923  24   0   7   9]
 [ 11   7  23   9  29  28 877   2   9   5]
 [  1   1   1   1   3   2   8 959   4  20]
 [  2   0   6   2  40   7   1   1 934   7]
 [  3   3   0   7  19   6   4   3   9 946]]
```

3.2 CNN 网络训练过程

```
Epoch [1/20]
Iter:      0,  Train Loss:   2.3,  Train Acc:  7.03%,  Val Loss:   2.6,  Val Acc: 10.00%,  Time: 0:00:07 *
Iter:    100,  Train Loss:  0.74,  Train Acc: 74.22%,  Val Loss:  0.69,  Val Acc: 78.65%,  Time: 0:00:44 *
Iter:    200,  Train Loss:   0.7,  Train Acc: 78.91%,  Val Loss:  0.55,  Val Acc: 83.19%,  Time: 0:01:15 *
Iter:    300,  Train Loss:  0.46,  Train Acc: 84.38%,  Val Loss:  0.48,  Val Acc: 85.01%,  Time: 0:01:45 *
Iter:    400,  Train Loss:  0.71,  Train Acc: 78.91%,  Val Loss:  0.47,  Val Acc: 85.48%,  Time: 0:02:21 *
Iter:    500,  Train Loss:  0.38,  Train Acc: 89.84%,  Val Loss:  0.44,  Val Acc: 86.62%,  Time: 0:03:19 *
Iter:    600,  Train Loss:  0.47,  Train Acc: 85.94%,  Val Loss:  0.43,  Val Acc: 86.65%,  Time: 0:04:16 *
Iter:    700,  Train Loss:  0.48,  Train Acc: 80.47%,  Val Loss:   0.4,  Val Acc: 87.58%,  Time: 0:05:04 *
Iter:    800,  Train Loss:  0.44,  Train Acc: 84.38%,  Val Loss:  0.39,  Val Acc: 88.20%,  Time: 0:06:12 *
Iter:    900,  Train Loss:   0.4,  Train Acc: 86.72%,  Val Loss:  0.38,  Val Acc: 88.08%,  Time: 0:07:20 *
Iter:   1000,  Train Loss:  0.34,  Train Acc: 91.41%,  Val Loss:  0.39,  Val Acc: 87.68%,  Time: 0:08:18
Iter:   1100,  Train Loss:  0.37,  Train Acc: 91.41%,  Val Loss:  0.38,  Val Acc: 88.30%,  Time: 0:08:58 *
Iter:   1200,  Train Loss:  0.34,  Train Acc: 88.28%,  Val Loss:  0.37,  Val Acc: 88.87%,  Time: 0:09:39 *
Iter:   1300,  Train Loss:  0.46,  Train Acc: 84.38%,  Val Loss:  0.36,  Val Acc: 88.83%,  Time: 0:10:14 *
Iter:   1400,  Train Loss:  0.52,  Train Acc: 85.16%,  Val Loss:  0.35,  Val Acc: 89.04%,  Time: 0:10:47 *
```

```
Epoch [2/20]
Iter:   1500,  Train Loss:  0.39,  Train Acc: 89.84%,  Val Loss:  0.35,  Val Acc: 88.98%,  Time: 0:11:18 *
Iter:   1600,  Train Loss:  0.25,  Train Acc: 91.41%,  Val Loss:  0.35,  Val Acc: 88.94%,  Time: 0:11:49
Iter:   1700,  Train Loss:  0.38,  Train Acc: 89.06%,  Val Loss:  0.35,  Val Acc: 89.41%,  Time: 0:12:19 *
Iter:   1800,  Train Loss:  0.31,  Train Acc: 90.62%,  Val Loss:  0.36,  Val Acc: 88.78%,  Time: 0:12:50
Iter:   1900,  Train Loss:  0.39,  Train Acc: 87.50%,  Val Loss:  0.35,  Val Acc: 89.40%,  Time: 0:13:21 *
Iter:   2000,  Train Loss:  0.36,  Train Acc: 88.28%,  Val Loss:  0.34,  Val Acc: 89.55%,  Time: 0:13:52 *
Iter:   2100,  Train Loss:  0.38,  Train Acc: 85.94%,  Val Loss:  0.34,  Val Acc: 89.40%,  Time: 0:14:23 *
Iter:   2200,  Train Loss:  0.32,  Train Acc: 89.06%,  Val Loss:  0.34,  Val Acc: 89.73%,  Time: 0:15:26 *
Iter:   2300,  Train Loss:  0.31,  Train Acc: 92.97%,  Val Loss:  0.34,  Val Acc: 89.66%,  Time: 0:16:26 *
Iter:   2400,  Train Loss:  0.23,  Train Acc: 92.97%,  Val Loss:  0.34,  Val Acc: 89.53%,  Time: 0:16:58
Iter:   2500,  Train Loss:  0.21,  Train Acc: 92.97%,  Val Loss:  0.34,  Val Acc: 89.96%,  Time: 0:17:31 *
Iter:   2600,  Train Loss:  0.42,  Train Acc: 89.84%,  Val Loss:  0.33,  Val Acc: 89.93%,  Time: 0:18:11 *
Iter:   2700,  Train Loss:  0.27,  Train Acc: 89.06%,  Val Loss:  0.33,  Val Acc: 89.99%,  Time: 0:18:43 *
Iter:   2800,  Train Loss:  0.45,  Train Acc: 83.59%,  Val Loss:  0.33,  Val Acc: 89.66%,  Time: 0:19:15
Epoch [3/20]
Iter:   2900,  Train Loss:  0.41,  Train Acc: 88.28%,  Val Loss:  0.33,  Val Acc: 89.90%,  Time: 0:19:48
Iter:   3000,  Train Loss:  0.22,  Train Acc: 94.53%,  Val Loss:  0.33,  Val Acc: 89.87%,  Time: 0:20:37
Iter:   3100,  Train Loss:  0.22,  Train Acc: 90.62%,  Val Loss:  0.33,  Val Acc: 90.00%,  Time: 0:21:21 *
Iter:   3200,  Train Loss:  0.42,  Train Acc: 92.19%,  Val Loss:  0.33,  Val Acc: 89.92%,  Time: 0:22:29
Iter:   3300,  Train Loss:   0.3,  Train Acc: 91.41%,  Val Loss:  0.32,  Val Acc: 90.11%,  Time: 0:23:34 *
Iter:   3400,  Train Loss:  0.27,  Train Acc: 90.62%,  Val Loss:  0.34,  Val Acc: 89.89%,  Time: 0:24:07
Iter:   3500,  Train Loss:  0.18,  Train Acc: 96.09%,  Val Loss:  0.32,  Val Acc: 90.13%,  Time: 0:24:38
Iter:   3600,  Train Loss:   0.2,  Train Acc: 93.75%,  Val Loss:  0.32,  Val Acc: 90.12%,  Time: 0:25:30
Iter:   3700,  Train Loss:   0.3,  Train Acc: 89.84%,  Val Loss:  0.32,  Val Acc: 90.17%,  Time: 0:26:09 *
Iter:   3800,  Train Loss:   0.3,  Train Acc: 90.62%,  Val Loss:  0.33,  Val Acc: 89.98%,  Time: 0:26:44
Iter:   3900,  Train Loss:   0.3,  Train Acc: 89.06%,  Val Loss:  0.33,  Val Acc: 90.01%,  Time: 0:27:16
Iter:   4000,  Train Loss:  0.22,  Train Acc: 94.53%,  Val Loss:  0.33,  Val Acc: 90.26%,  Time: 0:27:48
Iter:   4100,  Train Loss:   0.3,  Train Acc: 86.72%,  Val Loss:  0.32,  Val Acc: 90.27%,  Time: 0:28:38
Iter:   4200,  Train Loss:  0.37,  Train Acc: 89.06%,  Val Loss:  0.32,  Val Acc: 90.22%,  Time: 0:29:45
Epoch [4/20]
Iter:   4300,  Train Loss:   0.2,  Train Acc: 92.19%,  Val Loss:  0.32,  Val Acc: 90.08%,  Time: 0:30:54
Iter:   4400,  Train Loss:  0.19,  Train Acc: 95.31%,  Val Loss:  0.32,  Val Acc: 90.30%,  Time: 0:31:44 *
Iter:   4500,  Train Loss:   0.4,  Train Acc: 86.72%,  Val Loss:  0.32,  Val Acc: 90.56%,  Time: 0:32:16
Iter:   4600,  Train Loss:  0.25,  Train Acc: 92.97%,  Val Loss:  0.32,  Val Acc: 90.62%,  Time: 0:32:53
Iter:   4700,  Train Loss:  0.43,  Train Acc: 88.28%,  Val Loss:  0.32,  Val Acc: 90.40%,  Time: 0:33:23
Iter:   4800,  Train Loss:  0.16,  Train Acc: 93.75%,  Val Loss:  0.32,  Val Acc: 90.76%,  Time: 0:34:04
Iter:   4900,  Train Loss:  0.21,  Train Acc: 94.53%,  Val Loss:  0.32,  Val Acc: 90.71%,  Time: 0:34:35
Iter:   5000,  Train Loss:  0.22,  Train Acc: 92.97%,  Val Loss:  0.32,  Val Acc: 90.56%,  Time: 0:35:06
Iter:   5100,  Train Loss:  0.23,  Train Acc: 93.75%,  Val Loss:  0.31,  Val Acc: 90.73%,  Time: 0:35:36 *
Iter:   5200,  Train Loss:   0.3,  Train Acc: 91.41%,  Val Loss:  0.32,  Val Acc: 90.57%,  Time: 0:36:07
Iter:   5300,  Train Loss:  0.18,  Train Acc: 94.53%,  Val Loss:  0.32,  Val Acc: 90.66%,  Time: 0:36:43
Iter:   5400,  Train Loss:  0.34,  Train Acc: 92.19%,  Val Loss:  0.34,  Val Acc: 90.35%,  Time: 0:37:44
Iter:   5500,  Train Loss:  0.23,  Train Acc: 91.41%,  Val Loss:  0.32,  Val Acc: 90.73%,  Time: 0:38:35
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Iter:   5600,  Train Loss:  0.16,  Train Acc: 94.53%,  Val Loss:  0.32,  Val Acc: 90.43%,  Time: 0:39:25
Epoch [5/20]
Epoch [5/20]
Iter:   5700,  Train Loss:  0.28,  Train Acc: 92.19%,  Val Loss:  0.32,  Val Acc: 90.32%,  Time: 0:40:05
Iter:   5800,  Train Loss:  0.12,  Train Acc: 93.75%,  Val Loss:  0.32,  Val Acc: 90.64%,  Time: 0:40:42
Iter:   5900,  Train Loss:   0.2,  Train Acc: 93.75%,  Val Loss:  0.33,  Val Acc: 90.54%,  Time: 0:41:21
Iter:   6000,  Train Loss:  0.21,  Train Acc: 92.97%,  Val Loss:  0.33,  Val Acc: 90.42%,  Time: 0:41:53
Iter:   6100,  Train Loss:   0.2,  Train Acc: 92.19%,  Val Loss:  0.32,  Val Acc: 90.51%,  Time: 0:42:24
No optimization for a long time, auto-stopping...
Test Loss:  0.29,  Test Acc: 91.36%
Precision, Recall and F1-Score...
               precision    recall  f1-score   support

      finance     0.9215    0.8920    0.9065      1000
       realty     0.9276    0.9350    0.9313      1000
       stocks     0.8545    0.8630    0.8587      1000
    education     0.9570    0.9580    0.9575      1000
      science     0.8650    0.8780    0.8715      1000
      society     0.8873    0.9290    0.9077      1000
     politics     0.9143    0.8860    0.8999      1000
       sports     0.9635    0.9510    0.9572      1000
         game     0.9304    0.9090    0.9196      1000
entertainment     0.9185    0.9350    0.9267      1000

     accuracy                         0.9136     10000
    macro avg     0.9140    0.9136    0.9137     10000
 weighted avg     0.9140    0.9136    0.9137     10000

Confusion Matrix...
[[892  15  54   5  10  12   5   4   2   1]
 [ 13 935  16   2   7  11   4   1   1  10]
 [ 49  22 863   2  24   2  31   2   3   2]
 [  0   3   0 958   4  15   5   3   1  11]
 [  1   5  28   5 878  19  18   3  28  15]
 [  2  16   2  13  10 929  15   1   3   9]
 [  9   5  30   8  16  34 886   2   4   6]
 [  1   2   5   2   4   9   1 951   7  18]
 [  1   2   8   3  51   6   2   7 909  11]
 [  0   3   4   3  11  10   2  13  19 935]]
```