新闻主题分类--基于 Pytorch

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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 *

| Herri 200, Train Loss: 0.8, Train Acc: 53.918, Val Loss: 0.9, Val Acc: 56.558, Train Coss: 0.67, Train Acc: 67.538, Val Loss: 0.7, Val Acc: 68.894, Train Coss: 0.67, Train Acc: 68.478, Val Loss: 0.7, Val Acc: 68.894, Train Coss: 0.67, Train Acc: 82.038, Val Loss: 0.58, Val Acc: 82.438, Train Coss: 0.67, Train Acc: 82.038, Val Loss: 0.58, Val Acc: 82.438, Train Coss: 0.68, Train Acc: 82.038, Val Loss: 0.52, Val Acc: 83.488, Train Coss: 0.69, Train Loss: 0.48, Train Acc: 82.038, Val Loss: 0.51, Val Acc: 83.488, Train Coss: 0.69, Train Loss: 0.48, Train Acc: 80.688, Val Loss: 0.51, Val Acc: 83.488, Train Coss: 0.69, Train Loss: 0.48, Train Acc: 80.688, Val Loss: 0.48, Val Acc: 86.618, Train Coss: 0.48, Train Acc: 80.688, Val Loss: 0.48, Val Acc: 86.618, Train Coss: 0.37, Train Acc: 87.508, Val Loss: 0.48, Val Acc: 86.618, Train Coss: 0.37, Train Acc: 87.508, Val Loss: 0.48, Val Acc: 87.618, Train Coss: 0.37, Train Acc: 87.508, Val Loss: 0.48, Val Acc: 87.618, Train Coss: 0.37, Train Acc: 87.508, Val Loss: 0.48, Val Acc: 87.618, Train Coss: 0.37, Train Acc: 87.508, Val Loss: 0.38, Val Acc: 87.638, Train Coss: 0.38, Train Acc: 87.508, Val Loss: 0.38, Val Acc: 87.638, Train Coss: 0.39, Train Acc: 87.508, Val Loss: 0.38, Val Acc: 87.638, Train Coss: 0.39, Train Acc: 87.508, Val Loss: 0.38, Val Acc: 87.638, Train Coss: 0.39, Train Acc: 87.508, Val Loss: 0.38, Val Acc: 87.508, Train Coss: 0.39, Train Acc: 87.508, Val Loss: 0.38, Val Acc: 88.588, Train 0.18920 Val Acc: 88.688, Train 0.18920 Val Acc: 88.688, | | | | | | | | | |
|--|-------|--------|-------------|-------|--------------------|-----------|-------|------------------|-----------------|
| | Iter: | 200, | Train Loss: | 1.3, | Train Acc: 53.91%, | Val Loss: | 1. 2, | Val Acc: 56.55%, | Time: 0:02:13 * |
| Terri 1900 | Iter: | 300, | Train Loss: | 0.86, | Train Acc: 69.53%, | Val Loss: | 0.93, | Val Acc: 68.89%, | Time: 0:03:16 * |
| Here: 600 | Iter: | 400, | Train Loss: | 0.67, | Train Acc: 78.12%, | Val Loss: | 0.73, | Val Acc: 75.81%, | Time: 0:04:23 * |
| Train Loss O. 55, Train Acc: 79.69% Val Loss O. 52, Val Acc: 83.48% Time: 0.007.54 Val Iter: 900, Train Loss O. 55, Train Acc: 88.67.2% Val Loss O. 51, Val Acc: 83.88% Time: 0.009.14 Val Train Coss O. 52, Val Val Val Val Acc: 83.88% Time: 0.009.14 Val Val | Iter: | 500, | Train Loss: | 0.59, | Train Acc: 80.47%, | Val Loss: | 0.63, | Val Acc: 78.75%, | Time: 0:05:16 * |
| The control Section Control Control | 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 * |
| Here 1000 | Iter: | 800, | Train Loss: | 0.48, | Train Acc: 86.72%, | Val Loss: | 0.51, | Val Acc: 83.88%, | Time: 0:09:14 * |
| Train 1100 | Iter: | 900, | Train Loss: | 0.5, | Train Acc: 82.81%, | Val Loss: | 0.46, | Val Acc: 85.49%, | Time: 0:10:11 * |
| Here 1200 | Iter: | 1000, | Train Loss: | 0.32, | Train Acc: 89.06%, | Val Loss: | 0.44, | Val Acc: 86.05%, | Time: 0:11:04 * |
| Here 1300 | Iter: | 1100, | Train Loss: | 0.32, | Train Acc: 91.41%, | Val Loss: | 0.43, | Val Acc: 86.61%, | Time: 0:11:55 * |
| Train Loss: 1400, Train Loss: 0.48, Train Acc: 85.948, Val Loss: 0.4, Val Acc: 87.348, Time: 0.14:43 * | Iter: | 1200, | Train Loss: | 0.37, | Train Acc: 87.50%, | Val Loss: | 0.42, | Val Acc: 87.10%, | Time: 0:12:48 * |
| Fight 1500 1711 1500 | Iter: | 1300, | Train Loss: | 0.47, | Train Acc: 85.94%, | Val Loss: | 0.43, | Val Acc: 86.77%, | Time: 0:13:44 |
| Train Loss: 0.41, | Iter: | 1400, | Train Loss: | 0.48, | Train Acc: 85.94%, | Val Loss: | 0.4, | Val Acc: 87.34%, | Time: 0:14:43 * |
| Tetel 1600 | Epoch | [2/10] | | | | | | | |
| Tele | Iter: | 1500, | Train Loss: | 0.41, | Train Acc: 87.50%, | Val Loss: | 0.39, | Val Acc: 87.65%, | Time: 0:15:48 * |
| Here: 1800, Train Loss: 0.28, Train Acc: 89.84%, Val Loss: 0.38, Val Acc: 88.27%, Time: 0:18:21 * | Iter: | 1600, | Train Loss: | 0.39, | Train Acc: 85.16%, | Val Loss: | 0.39, | Val Acc: 87.80%, | Time: 0:16:40 |
| Here 1900, Train Loss 0.34, Train Acc 89.84%, Val Loss 0.35, Val Acc 88.86%, Time 0:19:20 8 | Iter: | 1700, | Train Loss: | 0.39, | Train Acc: 85.94%, | Val Loss: | 0.38, | Val Acc: 88.10%, | Time: 0:17:30 * |
| Train Loss Control Control | Iter: | 1800, | Train Loss: | 0.28, | Train Acc: 89.84%, | Val Loss: | 0.38, | Val Acc: 88.27%, | Time: 0:18:21 * |
| Train Loss Control Control | Iter: | 1900, | Train Loss: | 0.34, | Train Acc: 89.84%, | Val Loss: | 0.35, | Val Acc: 88.86%, | Time: 0:19:20 * |
| Train Loss: 0.21, Train Acc: 92.97%, Val Loss: 0.35, Val Acc: 89.18%, Time: 0:22:34 | Iter: | 2000, | Train Loss: | 0.38, | Train Acc: 87.50%, | Val Loss: | 0.35, | Val Acc: 88.83%, | Time: 0:20:27 |
| Train Loss: 0.27, Train Acc: 92.19%, Val Loss: 0.33, Val Acc: 89.30%, Time: 0:23:37 * | Iter: | 2100, | Train Loss: | 0.35, | Train Acc: 89.84%, | Val Loss: | 0.35, | Val Acc: 88.84%, | Time: 0:21:33 |
| 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: 0:27:07 Iter: 2600, 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: 89.64%, Val Loss: 0.32, Val Acc: 89.77%, Time: 0:31:24 * Iter: 3000, Train Loss: 0.26, Train Acc: 92.19%, Val Loss: 0.33, Val Acc: 89.37%, Time: 0:33:40 Iter: 3300, Train Loss: 0. | Iter: | 2200, | Train Loss: | 0.21, | Train Acc: 92.97%, | Val Loss: | 0.35, | Val Acc: 89.18%, | Time: 0:22:34 |
| 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] 89.68%, Val Loss: 0.32, Val Acc: 89.24%, Time: 0:31:24 * Iter: 3000, Train Loss: 0.26, Train Acc: 99.62%, Val Loss: 0.33, Val Acc: 89.88%, Time: 0:33:40 Iter: 3300, Train Loss: 0.27, Train Acc: | Iter: | 2300, | Train Loss: | 0.27, | Train Acc: 92.19%, | Val Loss: | 0.33, | Val Acc: 89.30%, | Time: 0:23:37 * |
| 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: 3000, Train Loss: 0.36, Train Acc: 90.62%, Val Loss: 0.32, Val Acc: 89.24%, Time: 0:31:24 * Iter: 3000, Train Loss: 0.26, Train Acc: 89.84%, Val Loss: 0.34, Val Acc: 89.88%, Time: 0:32:33 Iter: 3100, Train Loss: 0.23, Train Acc: 92.97%, Val Loss: 0.34, Val Acc: 89.38%, Time: 0:33:40 Iter: 3300, Train Loss: 0.27, Train Acc: 92.97%, Val Loss: 0.32, Val Acc: | Iter: | 2400, | Train Loss: | 0.32, | Train Acc: 89.06%, | Val Loss: | 0.36, | Val Acc: 88.59%, | Time: 0:24:36 |
| 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: 89.89%, 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: 3300, Train Loss: 0.27, Train Acc: 92.97%, Val Loss: 0.32, Val Acc: 89.38%, Time: 0:33:20 * Iter: 3400, Train Loss: 0.28, Train Acc: 91.41%, Val Loss: 0.31, Val Acc: | Iter: | 2500, | Train Loss: | 0.22, | Train Acc: 92.97%, | Val Loss: | 0.34, | Val Acc: 89.45%, | Time: 0:25:35 |
| 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: 89.38%, Time: 0:33:40 Iter: 3300, Train Loss: 0.27, Train Acc: 92.97%, Val Loss: 0.32, Val Acc: 89.38%, Time: 0:35:20 * Iter: 3400, Train Loss: 0.28, Train Acc: 91.41%, Val Loss: 0.32, Val Acc: 89.72%, Time: 0:36:09 Iter: 3500, Train Loss | Iter: | 2600, | Train Loss: | 0.38, | Train Acc: 89.06%, | Val Loss: | 0.35, | Val Acc: 89.07%, | Time: 0:27:07 |
| 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: 91.41%, Val Loss: 0.34, Val Acc: 89.15%, Time: 0:36:58 Iter: 3600, Train Loss: 0.19, Train Acc: 91.41%, Val Loss: 0.34, Val Acc: 89.15%, Time: 0:36:58 Iter: 3700, Train Loss: 0.34, Train Acc: 94.53%, Val Loss: 0.32, Val Acc: 90.16%, Time: 0:37:50 Iter: 3700, Train Loss: 0.29, Train Acc: 89.86%, Val Loss: 0.31, Val Acc: 90.11%, Time: 0:39:37 Iter: 3800, Train Loss: 0.29, Train Acc: 89.84%, Val Loss: 0.31, Val Acc: 90.01%, Time: 0:39:37 Iter: 3900, Train Loss: 0.25, Train Acc: 92.97%, Val Loss: 0.31, Val Acc: 90.17%, Time: 0:40:33 Iter: 4000, Train Loss: 0.25, Train Acc: 92.97%, Val Loss: 0.31, Val Acc: 90.14%, 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: 0.31, Val Acc: 90.11%, Time: 0:42:26 | Iter: | 2700, | Train Loss: | 0.3, | Train Acc: 92.97%, | Val Loss: | 0.33, | Val Acc: 89.02%, | Time: 0:28:36 * |
| 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. 97%, Val Loss: 0. 34, Val Acc: 89. 39%, Time: 0:33:40 Iter: 3200, Train Loss: 0. 23, 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: 0:36:58 Iter: 3500, Train Loss: 0. 23, Train Acc: 92. 19%, Val Loss: 0. 34, Val Acc: 89.15%, </td <td>Iter:</td> <td>2800,</td> <td>Train Loss:</td> <td>0.43,</td> <td>Train Acc: 87.50%,</td> <td>Val Loss:</td> <td>0.35,</td> <td>Val Acc: 89.24%,</td> <td>Time: 0:29:58</td> | Iter: | 2800, | Train Loss: | 0.43, | Train Acc: 87.50%, | Val Loss: | 0.35, | Val Acc: 89.24%, | Time: 0:29:58 |
| 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: 89.38%, Time: 0:33:40 Iter: 3200, Train Loss: 0.27, 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: 89.88%, Time: 0:35:20 * Iter: 3400, Train Loss: 0.28, Train Acc: 91.41%, Val Loss: 0.32, Val Acc: 89.89, Time: 0:35:20 * Iter: 3500, Train Loss: 0.23, Train Acc: 92.19%, Val Loss: 0.34, Val Acc: 89.72%, Time: 0:36:58 Iter: 3600, Train Loss: 0.19, Train Acc: 94.53%, Val Loss: 0.32, Val Acc: 89.15%, Time: | Epoch | [3/10] | | | | | | | |
| 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: 0.32, 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: 89.15%, Time: 0:37:50 Iter: 3700, Train Loss: 0.34, Train Acc: 89.06%, Val Loss: 0.31, Val Acc: 90.11%, Time: | Iter: | 2900, | Train Loss: | 0.36, | Train Acc: 90.62%, | Val Loss: | 0.32, | Val Acc: 89.77%, | Time: 0:31:24 * |
| 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: <td>Iter:</td> <td>3000,</td> <td>Train Loss:</td> <td>0.26,</td> <td>Train Acc: 89.84%,</td> <td>Val Loss:</td> <td>0.33,</td> <td>Val Acc: 89.88%,</td> <td>Time: 0:32:33</td> | Iter: | 3000, | Train Loss: | 0.26, | Train Acc: 89.84%, | Val Loss: | 0.33, | Val Acc: 89.88%, | Time: 0:32:33 |
| 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: 92. 97%, Val Loss: 0. 31, Val Acc: 89. 6 | Iter: | 3100, | Train Loss: | 0.23, | Train Acc: 92.19%, | Val Loss: | 0.34, | Val Acc: 89.39%, | Time: 0:33:40 |
| 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: 0.25, Train Acc: 92.19%, Val Loss: 0.31, Val Acc: 90.14%, Time: | Iter: | 3200, | Train Loss: | 0.33, | Train Acc: 92.97%, | Val Loss: | 0.33, | Val Acc: 89.38%, | Time: 0:34:29 |
| 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: 0.32, Val Acc: 90.11%, Time: | Iter: | 3300, | Train Loss: | 0.27, | Train Acc: 90.62%, | Val Loss: | 0.32, | Val Acc: 89.80%, | Time: 0:35:20 * |
| 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: | Iter: | 3400, | Train Loss: | 0.28, | Train Acc: 91.41%, | Val Loss: | 0.33, | Val Acc: 89.72%, | Time: 0:36:09 |
| 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 | Iter: | 3500, | Train Loss: | 0.23, | Train Acc: 92.19%, | Val Loss: | 0.34, | Val Acc: 89.15%, | Time: 0:36:58 |
| 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 | Iter: | 3600, | Train Loss: | 0.19, | Train Acc: 94.53%, | Val Loss: | 0.32, | Val Acc: 90.26%, | Time: 0:37:50 |
| 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 | Iter: | 3700, | Train Loss: | 0.34, | Train Acc: 89.06%, | Val Loss: | 0.31, | Val Acc: 90.11%, | Time: 0:38:40 * |
| 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 | Iter: | 3800, | Train Loss: | 0.29, | Train Acc: 89.84%, | Val Loss: | 0.32, | Val Acc: 90.01%, | Time: 0:39:37 |
| 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 | Iter: | 3900, | Train Loss: | 0.25, | Train Acc: 90.62%, | Val Loss: | 0.31, | Val Acc: 90.17%, | Time: 0:40:33 |
| Iter: 4200, Train Loss: 0.27, Train Acc: 92.19%, Val Loss: 0.32, Val Acc: 90.11%, Time: 0:43:42 | 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 |
| Epoch [4/10] | 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] | | | | | | | |

```
4300.
Iter:
              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 *
                                                                                            Time: 0:49:24 *
        4800,
               Train Loss: 0.14,
                                   Train Acc: 96.09%,
                                                        Val Loss:
                                                                   0.3,
                                                                          Val Acc: 90.55%,
Iter:
Iter:
        4900,
               Train Loss:
                             0.2,
                                   Train Acc: 93.75%,
                                                        Val Loss: 0.31,
                                                                          Val Acc: 90.50%,
                                                                                            Time: 0:50:11
                                                                          Val Acc: 90.17%,
Iter:
        5000.
              Train Loss: 0.19,
                                   Train Acc: 93.75%,
                                                        Val Loss: 0.32,
                                                                                            Time: 0:51:00
               Train Loss: 0.21,
                                                        Val Loss:
Iter:
        5100,
                                   Train Acc: 92.97%,
                                                                    0.3,
                                                                          Val Acc: 90.44%,
                                                                                            Time: 0:51:46
                                                                          Val Acc: 90.55%,
Iter:
        5200.
               Train Loss: 0.35,
                                   Train Acc: 89.06%,
                                                        Val Loss: 0.31,
                                                                                            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
        5500,
               Train Loss: 0.18,
                                   Train Acc: 92.97%,
                                                        Val Loss: 0.31,
                                                                          Val Acc: 90.18%,
                                                                                            Time: 0:55:15
Iter:
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
                                                                          Val Acc: 90.59%,
        6000.
               Train Loss: 0.21.
                                                                                            Time: 1:00:03
Iter:
                                   Train Acc: 92.97%,
                                                        Val Loss:
                                                                   0. 3.
        6100,
               Train Loss: 0.32,
                                   Train Acc: 91.41%,
                                                        Val Loss:
                                                                   0.3,
                                                                          Val Acc: 90.87%,
                                                                                            Time: 1:00:54
Iter:
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
        6500.
               Train Loss: 0.32.
                                   Train Acc: 89,84%.
                                                        Val Loss:
                                                                   0.3.
                                                                          Val Acc: 91.04%.
                                                                                            Time: 1:04:25 *
Iter:
        6600,
                                   Train Acc: 94.53%,
                                                        Val Loss: 0.32,
                                                                          Val Acc: 90.45%,
                                                                                            Time: 1:05:30
Iter:
               Train Loss: 0.16,
        6700.
              Train Loss: 0.13,
                                   Train Acc: 93, 75%,
                                                        Val Loss: 0.31,
                                                                          Val Acc: 90.84%,
                                                                                            Time: 1:06:21
Iter:
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]
       7100.
              Train Loss: 0.16, Train Acc: 93.75%,
                                                       Val Loss: 0.32,
                                                                          Val Acc: 90.74%,
                                                                                            Time: 1:09:44
Iter:
Iter:
        7200,
              Train Loss: 0.24,
                                  Train Acc: 92.97%,
                                                       Val Loss: 0.33,
                                                                          Val Acc: 90.42%,
                                                                                            Time: 1:10:43
                                                                          Val Acc: 90.92%,
Iter:
        7300.
              Train Loss: 0.12, Train Acc: 95.31%, Val Loss: 0.31,
                                                                                            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
       7500, Train Loss: 0.086, Train Acc: 98.44%, Val Loss: 0.32, Val Acc: 90.83%, Time: 1:13:28
Iter:
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 |

| | | scie | ence | | 0.8 | 139 | 0. | 8790 |) | 0.8452 | 1000 |
|----------|------|-------|------|------|---------|-----|------|------|--------|--------|-------|
| society | | | | 0.89 | 952 | 0. | 9230 |) | 0.9089 | 1000 | |
| politics | | | | | 0.89 | 931 | 0. | 8770 |) | 0.8850 | 1000 |
| sports | | | | | 0.98 | 887 | 0. | 9590 |) | 0.9736 | 1000 |
| game | | | | | 0. 9193 | | 0. | 9340 |) | 0.9266 | 1000 |
| ent | er | tain | nent | | 0.9 | 167 | 0. | 9460 | 0 | 0.9311 | 1000 |
| | | | | | | | | | | | |
| | é | accui | racy | | | | | | | 0.9086 | 10000 |
| | ma | acro | avg | | 0.90 |)94 | 0. | 9086 | 3 | 0.9087 | 10000 |
| W€ | eigh | nted | avg | | 0.90 |)94 | 0. | 9086 | 3 | 0.9087 | 10000 |
| | | | | | | | | | | | |
| Cor | ıfus | sion | Matı | cix | | | | | | | |
| [[8 | 397 | 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 9 946]]

3.2 CNN 网络训练过程

[3 3 0 7 19 6 4

```
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 *
                                                                                         Time: 0:00:44 *
        100, Train Loss: 0.74, Train Acc: 74.22%, Val Loss: 0.69,
                                                                        Val Acc: 78.65%,
Iter:
Iter:
             Train Loss:
                            0.7, Train Acc: 78.91%, Val Loss: 0.55,
                                                                        Val Acc: 83.19%,
                                                                                         Time: 0:01:15 *
                                                                        Val Acc: 85.01%,
Iter:
        300,
              Train Loss: 0.46,
                                  Train Acc: 84.38%, Val Loss: 0.48,
                                                                                          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 *
        500,
Iter:
              Train Loss: 0.38,
                                  Train Acc: 89.84%,
                                                      Val Loss: 0.44,
                                                                        Val Acc: 86.62%,
                                                                                         Time: 0:03:19 *
                                  Train Acc: 85.94%,
                                                      Val Loss: 0.43,
                                                                        Val Acc: 86.65%,
                                                                                          Time: 0:04:16 *
Iter:
        600,
              Train Loss: 0.47,
                                                                                         Time: 0:05:04 *
Iter:
        700,
              Train Loss: 0.48,
                                  Train Acc: 80.47%,
                                                      Val Loss:
                                                                 0.4,
                                                                        Val Acc: 87.58%,
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 *
                                                                        Val Acc: 88.87%,
Iter:
       1200,
              Train Loss: 0.34,
                                  Train Acc: 88.28%,
                                                     Val Loss: 0.37,
                                                                                          Time: 0:09:39 *
Iter:
              Train Loss: 0.46,
                                  Train Acc: 84.38%,
                                                      Val Loss: 0.36,
                                                                        Val Acc: 88.83%,
                                                                                          Time: 0:10:14 *
       1400,
              Train Loss: 0.52, Train Acc: 85.16%, Val Loss: 0.35, Val Acc: 89.04%, Time: 0:10:47 *
Iter:
```

| Epoch [2/20 |)] | | | | | | |
|-------------|-----------------|--------|--------------------|-----------|-------|------------------|-----------------|
| Iter: 150 | 00, Train Loss: | 0.39, | Train Acc: 89.84%, | Val Loss: | 0.35, | Val Acc: 88.98%, | Time: 0:11:18 * |
| Iter: 160 | 00, Train Loss: | 0.25, | Train Acc: 91.41%, | Val Loss: | 0.35, | Val Acc: 88.94%, | Time: 0:11:49 |
| Iter: 170 | 00, Train Loss: | 0.38, | Train Acc: 89.06%, | Val Loss: | 0.35, | Val Acc: 89.41%, | Time: 0:12:19 * |
| Iter: 180 | 00, Train Loss: | 0.31, | Train Acc: 90.62%, | Val Loss: | 0.36, | Val Acc: 88.78%, | Time: 0:12:50 |
| Iter: 190 | 00, Train Loss: | 0.39, | Train Acc: 87.50%, | Val Loss: | 0.35, | Val Acc: 89.40%, | Time: 0:13:21 * |
| Iter: 200 | 00, Train Loss: | 0.36, | Train Acc: 88.28%, | Val Loss: | 0.34, | Val Acc: 89.55%, | Time: 0:13:52 * |
| Iter: 210 | 00, Train Loss: | 0.38, | Train Acc: 85.94%, | Val Loss: | 0.34, | Val Acc: 89.40%, | Time: 0:14:23 * |
| Iter: 220 | 00, Train Loss: | 0.32, | Train Acc: 89.06%, | Val Loss: | 0.34, | Val Acc: 89.73%, | Time: 0:15:26 * |
| Iter: 230 | 00, Train Loss: | 0.31, | Train Acc: 92.97%, | Val Loss: | 0.34, | Val Acc: 89.66%, | Time: 0:16:26 * |
| Iter: 240 | 00, Train Loss: | 0. 23, | Train Acc: 92.97%, | Val Loss: | 0.34, | Val Acc: 89.53%, | Time: 0:16:58 |
| Iter: 250 | 00, Train Loss: | 0.21, | Train Acc: 92.97%, | Val Loss: | 0.34, | Val Acc: 89.96%, | Time: 0:17:31 * |
| Iter: 260 | 00, Train Loss: | 0.42, | Train Acc: 89.84%, | Val Loss: | 0.33, | Val Acc: 89.93%, | Time: 0:18:11 * |
| Iter: 270 | 00, Train Loss: | 0.27, | Train Acc: 89.06%, | Val Loss: | 0.33, | Val Acc: 89.99%, | Time: 0:18:43 * |
| Iter: 280 | 00, Train Loss: | 0.45, | Train Acc: 83.59%, | Val Loss: | 0.33, | Val Acc: 89.66%, | Time: 0:19:15 |
| Epoch [3/20 |)] | | | | | | |
| Iter: 290 | 00, Train Loss: | 0.41, | Train Acc: 88.28%, | Val Loss: | 0.33, | Val Acc: 89.90%, | Time: 0:19:48 |
| Iter: 300 | 00, Train Loss: | 0. 22, | Train Acc: 94.53%, | Val Loss: | 0.33, | Val Acc: 89.87%, | Time: 0:20:37 |
| Iter: 310 | 00, Train Loss: | 0.22, | Train Acc: 90.62%, | Val Loss: | 0.33, | Val Acc: 90.00%, | Time: 0:21:21 * |
| Iter: 320 | 00, Train Loss: | 0.42, | Train Acc: 92.19%, | Val Loss: | 0.33, | Val Acc: 89.92%, | Time: 0:22:29 |
| Iter: 330 | 00, Train Loss: | 0.3, | Train Acc: 91.41%, | Val Loss: | 0.32, | Val Acc: 90.11%, | Time: 0:23:34 * |
| Iter: 340 | 00, Train Loss: | 0.27, | Train Acc: 90.62%, | Val Loss: | 0.34, | Val Acc: 89.89%, | Time: 0:24:07 |
| Iter: 350 | 00, Train Loss: | 0.18, | Train Acc: 96.09%, | Val Loss: | 0.32, | Val Acc: 90.13%, | Time: 0:24:38 |
| Iter: 360 | 00, Train Loss: | 0.2, | Train Acc: 93.75%, | Val Loss: | 0.32, | Val Acc: 90.12%, | Time: 0:25:30 |
| Iter: 370 | 00, Train Loss: | 0.3, | Train Acc: 89.84%, | Val Loss: | 0.32, | Val Acc: 90.17%, | Time: 0:26:09 * |
| Iter: 380 | 00, Train Loss: | 0.3, | Train Acc: 90.62%, | Val Loss: | 0.33, | Val Acc: 89.98%, | Time: 0:26:44 |
| Iter: 390 | 00, Train Loss: | 0.3, | Train Acc: 89.06%, | Val Loss: | 0.33, | Val Acc: 90.01%, | Time: 0:27:16 |
| Iter: 400 | 00, Train Loss: | 0.22, | Train Acc: 94.53%, | Val Loss: | 0.33, | Val Acc: 90.26%, | Time: 0:27:48 |
| Iter: 410 | 00, Train Loss: | 0.3, | Train Acc: 86.72%, | Val Loss: | 0.32, | Val Acc: 90.27%, | Time: 0:28:38 |
| Iter: 420 | 00, Train Loss: | 0.37, | Train Acc: 89.06%, | Val Loss: | 0.32, | Val Acc: 90.22%, | Time: 0:29:45 |
| Epoch [4/20 |)] | | | | | | |
| Iter: 430 | 00, Train Loss: | 0.2, | Train Acc: 92.19%, | Val Loss: | 0.32, | Val Acc: 90.08%, | Time: 0:30:54 |
| Iter: 440 | 00, Train Loss: | 0.19, | Train Acc: 95.31%, | Val Loss: | 0.32, | Val Acc: 90.30%, | Time: 0:31:44 * |
| Iter: 450 | 00, Train Loss: | 0.4, | Train Acc: 86.72%, | Val Loss: | 0.32, | Val Acc: 90.56%, | Time: 0:32:16 |
| Iter: 460 | 00, Train Loss: | 0.25, | Train Acc: 92.97%, | Val Loss: | 0.32, | Val Acc: 90.62%, | Time: 0:32:53 |
| Iter: 470 | 00, Train Loss: | 0.43, | Train Acc: 88.28%, | Val Loss: | 0.32, | Val Acc: 90.40%, | Time: 0:33:23 |
| Iter: 480 | 00, Train Loss: | 0.16, | Train Acc: 93.75%, | Val Loss: | 0.32, | Val Acc: 90.76%, | Time: 0:34:04 |
| Iter: 490 | 00, Train Loss: | 0.21, | Train Acc: 94.53%, | Val Loss: | 0.32, | Val Acc: 90.71%, | Time: 0:34:35 |
| Iter: 500 | 00, Train Loss: | 0.22, | Train Acc: 92.97%, | Val Loss: | 0.32, | Val Acc: 90.56%, | Time: 0:35:06 |
| Iter: 510 | 00, Train Loss: | 0. 23, | Train Acc: 93.75%, | Val Loss: | 0.31, | Val Acc: 90.73%, | Time: 0:35:36 * |
| Iter: 520 | 00, Train Loss: | 0.3, | Train Acc: 91.41%, | Val Loss: | 0.32, | Val Acc: 90.57%, | Time: 0:36:07 |
| Iter: 530 | 00, Train Loss: | 0.18, | Train Acc: 94.53%, | Val Loss: | 0.32, | Val Acc: 90.66%, | Time: 0:36:43 |
| Iter: 540 | 00, Train Loss: | 0.34, | Train Acc: 92.19%, | Val Loss: | 0.34, | Val Acc: 90.35%, | Time: 0:37:44 |
| Iter: 550 | 00, Train Loss: | 0. 23, | Train Acc: 91.41%, | Val Loss: | 0.32, | Val Acc: 90.73%, | Time: 0:38:35 |

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... $\label{eq:precision} \mbox{precision} \quad \mbox{recall} \quad \mbox{f1-score} \quad \mbox{support}$

| | prooforon | 100411 | 11 00010 | Dapport |
|---------------|-----------|--------|----------|---------|
| | | | | |
| 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]