ACTIVE LEARNING DEEPAL

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ACTIVE LEARNING

Is "a method of learning in which students are actively or experientially involved in the learning process and where there are different levels of active learning, depending on student involvement.

Strategies

1. Margin Sampling
2. Entropy Sampling
3. LeastConfidence

1

Margin Sampling

The shortcoming of the LC strategy is that it only takes into consideration the most probable label and disregards the other label probabilities. The margin sampling strategy seeks to overcome this disadvantage by selecting the instance that has the smallest difference between the first and second most probable labels.

2

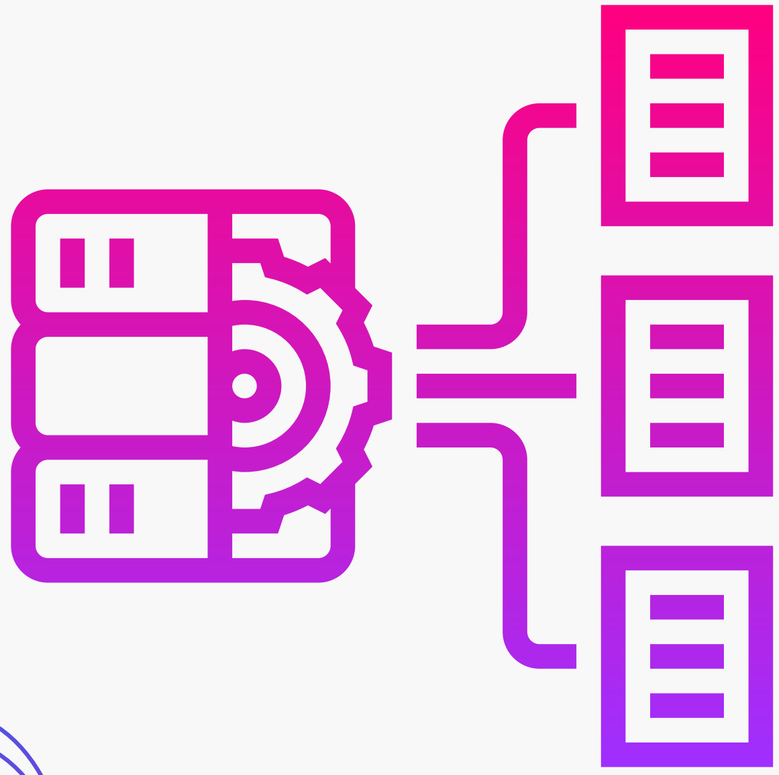
Entropy Sampling

This strategy measures the uncertainty of the predicted probability distribution of the classes. In other words, the query strategy chooses samples for which the model is most uncertain about the predicted probability distribution of the classes. In the code, it is implemented by selecting the samples with the highest entropy as measured by the predicted probability distribution. This strategy is useful when the model has low confidence or exhibits poor performance, but the samples it identifies are diverse and can help to better understand the data.

3

LeastConfidence

which is among the most popular approaches, the active learner sequentially queries the label of those instances for which its current prediction is maximally uncertain. Predictions as well as the measures used to quantify the degree of uncertainty, such as entropy, are traditionally of a probabilistic nature. Yet, alternative approaches to capturing uncertainty in machine learning, alongside with corresponding uncertainty measures, have been proposed in recent years. Some of these measures seek to distinguish different sources and to separate different types of uncertainty, such as the reducible (epistemic) and the irreducible (aleatoric) part of the total uncertainty in a prediction. The goal of this paper is to elaborate on the usefulness of such measures for uncertainty sampling, and to compare their performance in active learning.



1.Fashion MNIST dataset

2.CIFAR10 dataset

3.1.SVHN dataset

1 Fashion MNIST dataset

1 Margin Sampling

```
Round 0
100%|██████████| 10/10 [00:19<00:00,  1.97s/it]
Round 0 testing accuracy: 0.7167
Round 1
100%|██████████| 10/10 [00:20<00:00,  2.01s/it]
Round 1 testing accuracy: 0.7453
Round 2
100%|██████████| 10/10 [00:23<00:00,  2.38s/it]
Round 2 testing accuracy: 0.7577
Round 3
100%|██████████| 10/10 [00:27<00:00,  2.70s/it]
Round 3 testing accuracy: 0.7492
Round 4
100%|██████████| 10/10 [00:30<00:00,  3.02s/it]
Round 4 testing accuracy: 0.7795
Round 5
100%|██████████| 10/10 [00:34<00:00,  3.43s/it]
Round 5 testing accuracy: 0.7829
Round 6
100%|██████████| 10/10 [00:37<00:00,  3.70s/it]
Round 6 testing accuracy: 0.766
Round 7
100%|██████████| 10/10 [00:40<00:00,  4.01s/it]
Round 7 testing accuracy: 0.7985
Round 8
100%|██████████| 10/10 [00:43<00:00,  4.32s/it]
Round 8 testing accuracy: 0.791
Round 9
100%|██████████| 10/10 [00:47<00:00,  4.77s/it]
Round 9 testing accuracy: 0.8094
Round 10
100%|██████████| 10/10 [00:50<00:00,  5.07s/it]
Round 10 testing accuracy: 0.8125
```

2

Entropy Sampling

```
Round 0
100%|| 10/10 [00:18<00:00,  1.81s/it]
Round 0 testing accuracy: 0.7167
Round 1
100%|| 10/10 [00:25<00:00,  2.57s/it]
Round 1 testing accuracy: 0.7528
Round 2
100%|| 10/10 [00:24<00:00,  2.40s/it]
Round 2 testing accuracy: 0.7521
Round 3
100%|| 10/10 [00:27<00:00,  2.70s/it]
Round 3 testing accuracy: 0.7484
Round 4
100%|| 10/10 [00:30<00:00,  3.02s/it]
Round 4 testing accuracy: 0.7648
Round 5
100%|| 10/10 [00:32<00:00,  3.29s/it]
Round 5 testing accuracy: 0.7727
Round 6
100%|| 10/10 [00:37<00:00,  3.74s/it]
Round 6 testing accuracy: 0.7821
Round 7
100%|| 10/10 [00:39<00:00,  3.98s/it]
Round 7 testing accuracy: 0.771
Round 8
100%|| 10/10 [00:45<00:00,  4.52s/it]
Round 8 testing accuracy: 0.7787
Round 9
100%|| 10/10 [00:47<00:00,  4.71s/it]
Round 9 testing accuracy: 0.8064
Round 10
100%|| 10/10 [00:49<00:00,  4.94s/it]
Round 10 testing accuracy: 0.8038
```

3

LeastConfidence

```
Round 0
100%|| 10/10 [00:17<00:00,  1.77s/it]
Round 0 testing accuracy: 0.7167
Round 1
100%|| 10/10 [00:19<00:00,  1.94s/it]
Round 1 testing accuracy: 0.7528
Round 2
100%|| 10/10 [00:23<00:00,  2.32s/it]
Round 2 testing accuracy: 0.7521
Round 3
100%|| 10/10 [00:26<00:00,  2.66s/it]
Round 3 testing accuracy: 0.7484
Round 4
100%|| 10/10 [00:29<00:00,  2.99s/it]
Round 4 testing accuracy: 0.7648
Round 5
100%|| 10/10 [00:34<00:00,  3.40s/it]
Round 5 testing accuracy: 0.7727
Round 6
100%|| 10/10 [00:36<00:00,  3.65s/it]
Round 6 testing accuracy: 0.7821
Round 7
100%|| 10/10 [00:41<00:00,  4.11s/it]
Round 7 testing accuracy: 0.771
Round 8
100%|| 10/10 [00:43<00:00,  4.37s/it]
Round 8 testing accuracy: 0.7787
Round 9
100%|| 10/10 [00:46<00:00,  4.63s/it]
Round 9 testing accuracy: 0.8064
Round 10
100%|| 10/10 [00:49<00:00,  4.96s/it]
Round 10 testing accuracy: 0.8038
```

1 Corona_NLpdataset

1 Margin Sampling

```
Round 0
100%|| 20/20 [00:44<00:00,  2.23s/it]
Round 0 testing accuracy: 0.5016
Round 1
100%|| 20/20 [00:51<00:00,  2.58s/it]
Round 1 testing accuracy: 0.5094
Round 2
100%|| 20/20 [00:58<00:00,  2.91s/it]
Round 2 testing accuracy: 0.5
Round 3
100%|| 20/20 [01:07<00:00,  3.38s/it]
Round 3 testing accuracy: 0.5524
Round 4
100%|| 20/20 [01:15<00:00,  3.77s/it]
Round 4 testing accuracy: 0.5665
Round 5
100%|| 20/20 [01:23<00:00,  4.19s/it]
Round 5 testing accuracy: 0.5373
Round 6
100%|| 20/20 [01:31<00:00,  4.58s/it]
Round 6 testing accuracy: 0.5836
Round 7
100%|| 20/20 [01:39<00:00,  4.99s/it]
Round 7 testing accuracy: 0.5831
Round 8
100%|| 20/20 [01:48<00:00,  5.43s/it]
Round 8 testing accuracy: 0.4821
Round 9
100%|| 20/20 [01:55<00:00,  5.80s/it]
Round 9 testing accuracy: 0.6113
Round 10
100%|| 20/20 [02:05<00:00,  6.26s/it]
Round 10 testing accuracy: 0.5956
```

3

Entropy Sampling

```
Round 0
100%|| 10/10 [00:17<00:00,  1.75s/it]
Round 0 testing accuracy: 0.7167
Round 1
100%|| 10/10 [00:20<00:00,  2.05s/it]
Round 1 testing accuracy: 0.7528
Round 2
100%|| 10/10 [00:23<00:00,  2.34s/it]
Round 2 testing accuracy: 0.7521
Round 3
100%|| 10/10 [00:26<00:00,  2.64s/it]
Round 3 testing accuracy: 0.7484
Round 4
100%|| 10/10 [00:29<00:00,  2.90s/it]
Round 4 testing accuracy: 0.7648
Round 5
100%|| 10/10 [00:32<00:00,  3.22s/it]
Round 5 testing accuracy: 0.7727
Round 6
100%|| 10/10 [00:36<00:00,  3.62s/it]
Round 6 testing accuracy: 0.7821
Round 7
100%|| 10/10 [00:38<00:00,  3.87s/it]
Round 7 testing accuracy: 0.771
Round 8
100%|| 10/10 [00:41<00:00,  4.16s/it]
Round 8 testing accuracy: 0.7787
Round 9
100%|| 10/10 [00:44<00:00,  4.47s/it]
Round 9 testing accuracy: 0.8064
Round 10
100%|| 10/10 [00:48<00:00,  4.81s/it]
Round 10 testing accuracy: 0.8038
```

3

LeastConfidence

```
Round 0
100%|| 20/20 [00:43<00:00,  2.19s/it]
Round 0 testing accuracy: 0.5016
Round 1
100%|| 20/20 [00:51<00:00,  2.55s/it]
Round 1 testing accuracy: 0.5325
Round 2
100%|| 20/20 [00:59<00:00,  2.97s/it]
Round 2 testing accuracy: 0.4984
Round 3
100%|| 20/20 [01:08<00:00,  3.41s/it]
Round 3 testing accuracy: 0.5596
Round 4
100%|| 20/20 [01:15<00:00,  3.79s/it]
Round 4 testing accuracy: 0.5265
Round 5
100%|| 20/20 [01:24<00:00,  4.22s/it]
Round 5 testing accuracy: 0.5255
Round 6
100%|| 20/20 [01:34<00:00,  4.70s/it]
Round 6 testing accuracy: 0.574
Round 7
100%|| 20/20 [01:42<00:00,  5.12s/it]
Round 7 testing accuracy: 0.5811
Round 8
100%|| 20/20 [01:50<00:00,  5.52s/it]
Round 8 testing accuracy: 0.4811
Round 9
100%|| 20/20 [01:57<00:00,  5.88s/it]
Round 9 testing accuracy: 0.6143
Round 10
100%|| 20/20 [02:05<00:00,  6.28s/it]
Round 10 testing accuracy: 0.505
```

1 heart dataset

1 Margin Sampling

```
Round 0
100%|| 20/20 [00:43<00:00,  2.18s/it]
Round 0 testing accuracy: 0.1958743085433313
Round 1
100%|| 20/20 [00:51<00:00,  2.57s/it]
Round 1 testing accuracy: 0.22353257529194837
Round 2
100%|| 20/20 [00:59<00:00,  2.96s/it]
Round 2 testing accuracy: 0.27996312231100184
Round 3
100%|| 20/20 [01:07<00:00,  3.37s/it]
Round 3 testing accuracy: 0.37803472649047326
Round 4
100%|| 20/20 [01:15<00:00,  3.78s/it]
Round 4 testing accuracy: 0.7283727719729564
Round 5
100%|| 20/20 [01:22<00:00,  4.14s/it]
Round 5 testing accuracy: 0.357559926244622
Round 6
100%|| 20/20 [01:32<00:00,  4.63s/it]
Round 6 testing accuracy: 0.41034111862323297
Round 7
100%|| 20/20 [01:40<00:00,  5.04s/it]
Round 7 testing accuracy: 0.7738936693300553
Round 8
100%|| 20/20 [01:49<00:00,  5.46s/it]
Round 8 testing accuracy: 0.3695835894283958
Round 9
100%|| 20/20 [01:56<00:00,  5.81s/it]
Round 9 testing accuracy: 0.6091733251382914
Round 10
100%|| 20/20 [02:06<00:00,  6.33s/it]
Round 10 testing accuracy: 0.5547403196066379
```

3

Entropy Sampling

```
Round 0
100%|| 20/20 [00:42<00:00,  2.15s/it]
Round 0 testing accuracy: 0.1958743085433313
Round 1
100%|| 20/20 [00:50<00:00,  2.53s/it]
Round 1 testing accuracy: 0.1958743085433313
Round 2
100%|| 20/20 [00:59<00:00,  2.96s/it]
Round 2 testing accuracy: 0.1958743085433313
Round 3
100%|| 20/20 [01:07<00:00,  3.38s/it]
Round 3 testing accuracy: 0.24097264904732638
Round 4
100%|| 20/20 [01:15<00:00,  3.77s/it]
Round 4 testing accuracy: 0.6229640442532268
Round 5
100%|| 20/20 [01:22<00:00,  4.15s/it]
Round 5 testing accuracy: 0.32521511985248924
Round 6
100%|| 20/20 [01:31<00:00,  4.59s/it]
Round 6 testing accuracy: 0.5084511370620775
Round 7
100%|| 20/20 [01:40<00:00,  5.00s/it]
Round 7 testing accuracy: 0.6824677320221266
Round 8
100%|| 20/20 [01:47<00:00,  5.37s/it]
Round 8 testing accuracy: 0.20520897357098955
Round 9
100%|| 20/20 [01:55<00:00,  5.78s/it]
Round 9 testing accuracy: 0.33335894283958206
Round 10
100%|| 20/20 [02:04<00:00,  6.23s/it]
Round 10 testing accuracy: 0.46711739397664415
```

3

LeastConfidence

```
Round 0
100%|| 20/20 [00:44<00:00,  2.23s/it]
Round 0 testing accuracy: 0.1958743085433313
Round 1
100%|| 20/20 [00:52<00:00,  2.62s/it]
Round 1 testing accuracy: 0.19683466502765826
Round 2
100%|| 20/20 [00:58<00:00,  2.93s/it]
Round 2 testing accuracy: 0.2570682237246466
Round 3
100%|| 20/20 [01:06<00:00,  3.32s/it]
Round 3 testing accuracy: 0.40050706822372467
Round 4
100%|| 20/20 [01:15<00:00,  3.76s/it]
Round 4 testing accuracy: 0.6672172710510141
Round 5
100%|| 20/20 [01:22<00:00,  4.13s/it]
Round 5 testing accuracy: 0.3233328211432084
Round 6
100%|| 20/20 [01:30<00:00,  4.54s/it]
Round 6 testing accuracy: 0.556699446834665
Round 7
100%|| 20/20 [01:41<00:00,  5.06s/it]
Round 7 testing accuracy: 0.7468500307314075
Round 8
100%|| 20/20 [01:47<00:00,  5.39s/it]
Round 8 testing accuracy: 0.3332437000614628
Round 9
100%|| 20/20 [01:57<00:00,  5.89s/it]
Round 9 testing accuracy: 0.4459895513214505
Round 10
100%|| 20/20 [02:03<00:00,  6.18s/it]
Round 10 testing accuracy: 0.3816456668715427
```

As wesee that deep active learning has many strategies, these strategies we can’t say that one of them is the best because it dependent on the data itself, so we should try many of them until find the best for our data.


Thank
You