|  |  |
| --- | --- |
| **Yomna Taher Abdallah** | **20190624** |
| **Adel Abdel-monem Arfa** | **20190280** |

**Our report includes an overview of using deep Active Learning ModAL, with different strategies(DeepAL).**

**We used three datasets (FashionMNIST dataset, CIFAR10, SVHN).**

## **Dataset brief**

1. **Fashion MNIST dataset**

Fashion-MNIST is a dataset of Zalando's article images—consisting of a training set of 60,000 examples and a test set of 10,000 examples. Each example is a 28x28 grayscale image, associated with a label from 10 classes. Zalando intends Fashion-MNIST to serve as a direct drop-in replacement for the original MNIST dataset for benchmarking machine learning algorithms. It shares the same image size and structure of training and testing splits.

Content

Each image is 28 pixels in height and 28 pixels in width, for a total of 784 pixels in total. Each pixel has a single pixel-value associated with it, indicating the lightness or darkness of that pixel, with higher numbers meaning darker. This pixel-value is an integer between 0 and 255.

**Labels**

Each training and test example is assigned to one of the following labels:

* 0 T-shirt/top
* 1 Trouser
* 2 Pullover
* 3 Dress
* 4 Coat
* 5 Sandal
* 6 Shirt
* 7 Sneaker
* 8 Bag
* 9 Ankle boot

1. **CIFAR10**

This is a dataset of 50,000 32x32 color training images and 10,000 test images, labeled over 10 categories. See more info at the [CIFAR homepage](https://www.cs.toronto.edu/~kriz/cifar.html).

The classes are:

1. Airplane
2. Automobile
3. Bird
4. Cat
5. Deer
6. Dog
7. Frog
8. Hoarse
9. Ship
10. Truck
11. **SVHN**

SVHN is a real-world image dataset for developing machine learning and object recognition algorithms with minimal requirement on data preprocessing and formatting.

It can be seen as similar in flavor to MNIST (e.g., the images are of small, cropped digits), but incorporates an order of magnitude more labeled data (over 600,000-digit images)

and comes from a significantly harder, unsolved, real-world problem (recognizing digits and numbers in natural scene images). SVHN is obtained from house numbers in Google Street View images. **numbers in Google Street View images.**

**Strategies**

* **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.**
* **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.**
* **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.**

**Our Results**

**1.Fashion MNIST:**

**Margin Sampling**

A picture containing graphical user interface

Description automatically generated

**Entropy Sampling**

A picture containing graphical user interface

Description automatically generated

A picture containing diagram

Description automatically generated**LeastConfidence**

**1.CIFAR10:**

**Margin Sampling**

A picture containing text

Description automatically generated

**Entropy Sampling**

Text

Description automatically generated with low confidence

**Least Confidence**

A picture containing text

Description automatically generated

**1.SVHN:**

A picture containing text

Description automatically generated**Margin Sampling**

**Entropy Sampling**

A picture containing text

Description automatically generated

**Least Confidence**

A picture containing text

Description automatically generated

**As we see 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.**