

MACHINE LEARNING TECHNOLOGY

HOMEWORK 1

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1.a

Simple answer to this question would be a straight no. A discriminator is nothing but a classifier in other words. In order to code the same logic as a discriminator using something like a conventional programming paradigm, we would have to define rules to recognize real life images whereas a GAN works basically by learning from data. As explained by our professor, a GAN learns to discriminate images as either real or fake based on a dataset which is mostly a probabilistic approach or a data-driven approach which is very hard to code manually.

In the case of veracity of tweets, I think that it would be more feasible to use machine learning where we can train models and make use of labeled data to recognize if a tweet is true or false (1 or 0) rather than depending on hardcoded logic.

1.b

Upon searching for jobs and internships with machine learning terms in the job description I understood a few things. Some of the jobs were domain centric, for example there were jobs that required you to have some kind of knowledge in the healthcare domain, banking domain etc. I observed in most cases requirements to be proficient in SQL, Python and R were very common. Unlike building small proof of concept models, companies mostly require you to build production-grade machine learning systems which would include aspects like model training, tuning as well as monitoring said models. And the best part is all the job posting pay upwards of 45-65\$/ hour which shows how much demand machine learning engineers have in the current market.

2.a

- a) Web page: Factual accuracy, dates and timestamps, domain, links and citations, presence of clickbait (1 or 0), Shares and engagement, metadata.
- b) Student homework: plagiarism detection, citation, quality of grammar, originality or novelty, on time submissions
- c) News Item in a daily: Sources, Authors, Citation, language use, factual cross-checking, bias, discussions
- d) Image on Instagram: Image quality, image metadata, source, NSFW, metrics (likes, comments, shares and saves), captions, false information crosschecking.
- e) video on YouTube: content quality, metrics (likes, dislikes, comments), timestamps, disclaimers, sponsors, content warnings.

2.b

Last semester I coded a data engineer project with coin API and the algorithm I used was a simple extract-transform-load algorithm after which I generated reports based on price trends, volatility etc. I did wonder back then if I could simplify this process and increase the accuracy of the reports by just making use of machine learning. In retrospect I believe I could have made use of predictive modelling to predict future bitcoin prices or trends with the help of models like decision trees or LSTM networks. And mostly shifting towards machine learning would have helped in automation as training ML model results in automating complex tasks which I had done like forecasting and anomaly detection in the longer run.

3.a

I tried to replicate the tutorial in R to the best of my knowledge the results were not the same. Some reason this might have happened is library implementation as R is using `glm()` in the tutorial and in the case of python I used `Logit()` which leads in different usage of libraries for optimization. One more reason as far as I know why this might have happened is how differently R handles the formula interpretation. I have attached the pdf version of the ipynb file for reference.

3b.

There are some key takeaways like weights are parameters that are learned during the training of the model. Each feature gets a weight, and these weights define how much influence each feature has on the classification. The model typically makes use of a activation function like a sigmoid function to get the final predicted result. Based on how the features interact with the learned weights we can determine the predictions.

4a.

Upon reading through A gentle introduction to the rectified Linear Unit by Jason Brownlee, I take it that for our use case of deciding the truthfulness of a tweet we can make use of the `relu` function as it is fast and efficient, it is also known to be widely used so if we were to run into any problems resources are readily available. I found another less know function called `swish` published by google. According to the research paper, this function seems to outperform ReLU in some cases so we could also take this function into consideration.

4b.

The code given initially by ChatGPT seems to classify all the test samples correctly and has an almost perfect performance since it's a binary classification problem. I tired doing the same thing

with ReLU and the accuracy dipped by almost 3%. I think this happened since the data we are running the model on is small, maybe on a bigger, real-world dataset ReLU will perform better but in this specific instance it did worsen the results upon changing the model from sigmoid to ReLU.

4c.

In the second class to approach tweet truthfulness problem we first discussed a bunch of features that would be in a true tweet and then approached it as a classification problem to classify if a tweet is true or not. Considering spam detection as a classification problem, we can first identify features that can classify if a message is spam or not. Some features would be account age as there are more chances that a message is spam if it is coming from a newer account. We have also observed in the past, apps like Instagram, spam messages come from accounts had little to no followers so number of followers can be one of the features. The number of messages sent in a day can also be a feature since spam accounts send loads of messages at once and finally if we can observe the number of hashtags being large It can also be classified as a spam account. It is a binary classification problem (spam or not spam) and can be solved similar to the tweet problem with the correct features.

References:

- Swish: A self-gate activation function by Prajit Ramachandran, Barret Zoph, Quoc V.Le
- A Gentle Introduction to the Rectified Linear Unit (ReLU) by Jason Brownlee
- UC Irvine Machine Learning repository for Iris Dataset
- Introduction to spam detection Medium Article
- Scikit learn Documentation
- Pattern Recognition and Machine learning by Christopher Bishop