Fake Review Detection Using Transfer Learning

A Machine Learning Product
by Sam Middleton

Business Case

Consumer trust is of the utmost importance for online marketplaces and fake reviews undermines this trust.

We seek to affirm consumer trust be using Machine Learning to find these reviews.

The Process

Data
51 million book reviews from Amazon

01

First Model
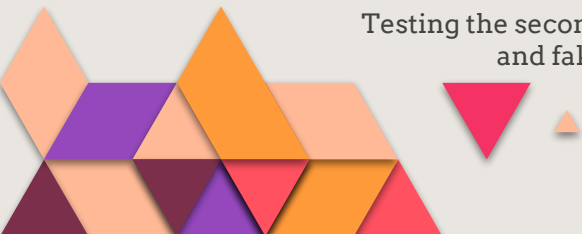Using book reviews to tune a network that generates reviews to train on.

02

Second Model
Using real reviews and reviews generated from our first model to tune a classifier to detect the fake reviews.

03

Testing
Testing the second model on a selection of real and fake reviews that it has not seen.

04

Data

Amazon Reviews

The data used to generate our fake reviews and train our second model are Amazon book reviews.

- 51 Million reviews total, 50 thousand sampled randomly for use.
- JSON Format - A file format that uses human readable text to store data in a key:value pair.
- Contains information such as:
  - Star rating
  - Text review
  - Item/Book name
  - Verified Purchaser flag

Data Length Exploration
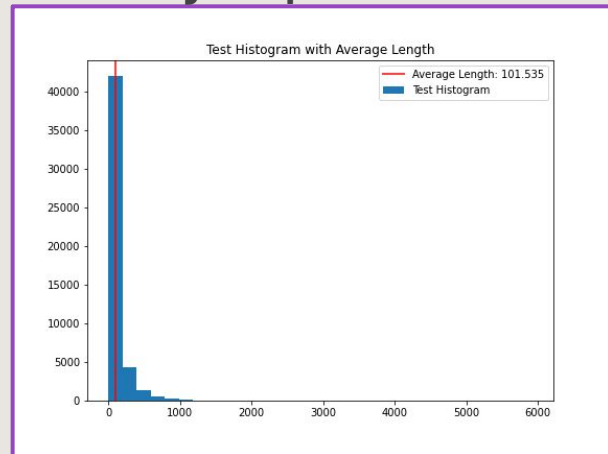
JSON Object

```
{'_id': ObjectId('5fc928d03a06ca0ca8587125'),
 'overall': 5,
 'verified': True,
 'reviewTime': '10 21, 2017',
 'reviewerID': 'AK2I3FIPVFXF6',
 'asin': '0151262276',
 'style': {'Format:': ' Paperback'},
 'reviewerName': 'Jane L. Smith',
 'reviewText': 'One of the funniest books I have ever read.  Good to give to someone who needs a laugh.  A very easy and quick read.',
 'summary': 'Good to give to someone who needs a laugh',
 'unixReviewTime': 1508544000},
```

Review Generation Model

Training Statistics

OpenAI's GPT2

GPT2 is the second iteration of the GPT architecture, which simply put a neural network already structured and trained specifically for language processing.

The model takes a 4 word sequence as a prompt, and here is an example of what it can do:

```
Real review prompt:Thorough reporting of the long ago crime.  Gives insight into the lives of those affected.  Especially liked
the bonus chapter.

Fake review from prompt: Thorough reporting of the political, economic, and cultural influences which have shaped this country.
This is a great, well researched book that covers important issues.
```

Training and Testing loss represent how well the model fared in learning the material presented.

Training & Testing Loss
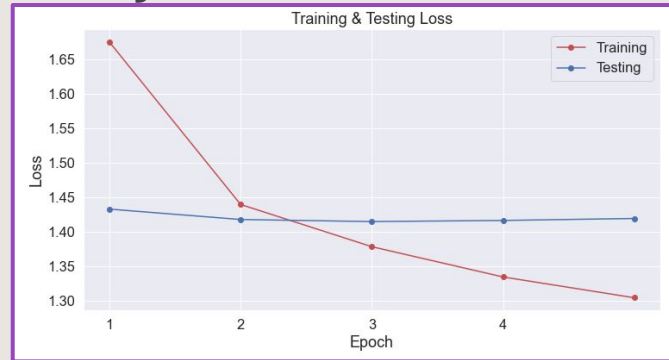
Neural Networks:

A system of mathematical operations that seek to simulate how the human brain learns and develops knowledge of context.

Fake Review Classifier

Google AI's BERT

BERT is very similar to GPT, but it is more specialized towards classification of text. We used our generated and obtained reviews to fine-tune BERT for classifying book reviews.
Confusion matrices just show how many the model truly classified as Fake (True Positive), how many it classified as Fake but were Real (False Positive), how many truly classified as Real (True Negative), and how many it classified as Real but were Fake (False Negative).
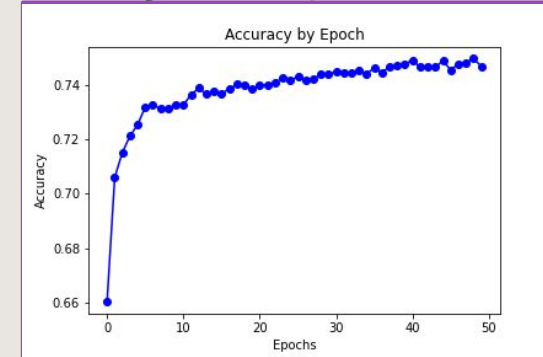A normalized confusion matrix just shows the same data but as percentages

We are predicting fake reviews at an **80% Accuracy**!
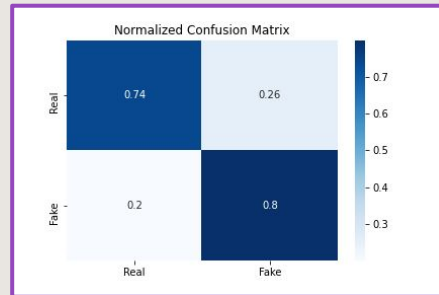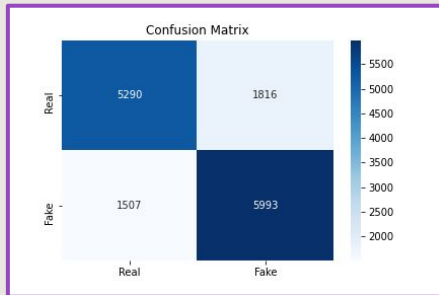
Training Statistics
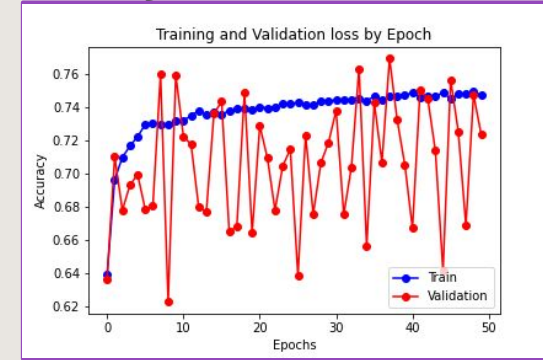
Training Accuracy

Recommendations

Transfer Learning
As we have done here, transfer learning is the process where we use a pretrained model as a base.

In order to stay ahead of those that generate these reviews **we recommend maintaining the latest in transfer learning models.**

Benefits:

- Cost Efficiency - These models are general released free and open source.
- Time Efficiency - Without the pretrained models developing and training would take significantly longer and use much more resources.

Training
Training the BERT classifier for a much longer time is **HIGHLY RECOMMENDED**.

The paper BERT is based on recommended training for 1 million steps, or approximately 40 epochs. As proof of concept we have trained for 5 epochs.

Deployment
Much of the focus we put into the project was so it could be setup as a marketplace backend, however **we recommend investing in the development of a consumer facing product that utilizes this technology.**

This consumer facing tech could be deployed as a Software as a Service (SaaS) operation.

Future Works

Deployment
The biggest goal and the next step of the process in developing this into a full machine learning product would be to deploy this model to a market backend or customer facing app.

Tuning
Our next step after deployment would be further tuning, so our model can head towards 99%+ accuracy at classifying a review as bot generated.

THANKS!

Name	Sam Middleton
LinkedIn	https://www.linkedin.com/in/samuel-midd leton-a8533491/
Github	https://github.com/emperorner0
EMAIL	samuelmiddleton93@gmail.com

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