CSC 215-01 Artificial Intelligence

Project 3: A Multi-Modal Deep Learning Model for Fake News Detection

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Course Title	**CSC- 215, Artificial Intelligence**
Assignment ID	**Project 3**
Due Date	**March 27, 2023**

Problem Statement :

The problem statement is to build a multi-modal deep learning model for detecting fake news on social media, using both textual and visual inputs. The aim is to automatically detect manipulation and misuse in Web multimedia content, and to provide a binary decision representing verification of whether the multimedia item reflects the reality of the event in the way purported by the tweet. The dataset provided consists of tweets and accompanying multimedia items (images or videos) from events that have the profile to be of interest in the international news. The proposed model aims to assist media professionals in the process of social media information verification.

Methodology:

Preprocessing and loading the images:

The dataset had csv file which has the tweets and corresponding image ids and labels, along with other columns such as username, ID, timestamp and other details. We have filtered only the tweets with labels 'real' or 'fake'. Then loaded the images from the folders. Some of the images were missing in the dataset. So, we removed the tweets from the dataframe for which the corresponding images do not exist. Now we stacked the images to make it compatible to be fed to machine learning algorithms.

Model:

We built a deep learning model which takes 2 inputs - tweet text and images, and outputs a binary decision. The model architecture using GloVe word embeddings to encode the text input and CNN layer to process the input images.

We are processing the image data through a convolutional neural network (CNN) consisting of a single convolutional layer and a max pooling layer, before being flattened and passed through another dense layer.

The outputs of the dense layers for the text and image inputs are concatenated and passed through another dense layer before finally being outputted as a binary classification.

The model is compiled using the categorical cross-entropy loss function and the Adam optimizer. It is trained for 10 epochs with a batch size of 32 and a validation split of 0.2, and early stopping is used as a callback to prevent overfitting.

Experimental Results and Analysis:

Classification report: Using Dense Layer for images

	Precision	**Recall**	**F1-score**	**support**
Real	0.99	0.55	0.71	610
Fake	0.81	1.00	0.90	1202

Classification report: Using LSTM Layer for images

	Precision	**Recall**	**F1-score**	**support**
Real	1.00	0.37	0.54	610
Fake	0.76	1.00	0.86	1202

Task Division and Project Reflection:

Initially we both started working together on preprocessing the data and building the model. We faced many issues while loading the images and extracting them. We faced challenges while matching the textual data to the image data. Also we came across issues while performing the model fitting in order for conversion of string type to floating points.
We managed to resolve all these issues and we learnt how to use multiple input and give an output. We learnt using both textual and visual data. However, we also tried improving our F1 score, but we could manage to not improve it much.

Additional Features:

VGG16: