

CSC 215-01 Artificial Intelligence (Spring 2023)

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

Due at 3:00 pm, Monday, March 27, 2023

Demo: class time, Monday, March 27, 2023

1. Problem Formulation

In this project, we will build a multi-modal deep learning model for fake news (tweets) detection on social media by using both textual (tweets) and visual inputs (images). This proposed model aims to deal with the automatic detection of manipulation and misuse in Web multimedia content, which lays the basis for a future generation of tools that could assist media professionals in the process of social media information verification.

The problem we aim to solve is the following: *"Given a tweet and the accompanying multimedia item (image or video) from an event that has the profile to be of interest in the international news, return a binary decision representing verification of whether the multimedia item reflects the reality of the event in the way purported by the tweet."*

2. Dataset

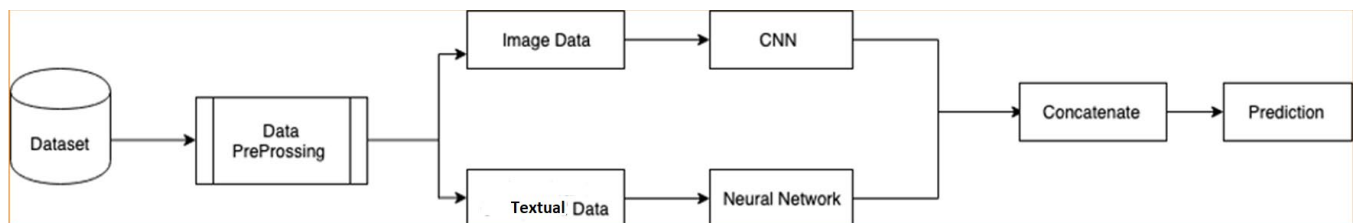
This dataset contains ~400 images that are used in about ~20K different tweets in the context of ~10 events (Hurricane Sandy, Boston Marathon bombings, etc.). Download the dataset here:

<https://github.com/MKLab-ITI/image-verification-corpus/tree/master/mediaeval2015>

You can find the detailed data description here:

<http://www.multimediaeval.org/mediaeval2015/verifyingmultimediause/index.html>

3. Model Design



We will build a deep learning model with two inputs and one output using TensorFlow Functional API. To speed up training, you may want to use Google Colab GPU.

4. Requirements

- Use the data in the “devset” folder to train your models and test the model using the data in the “testset” folder
- Remove the label “humor” since we only focus on “fake” and “real” tweets
- Remove all the tweets that have no corresponding images.
- To encode the text, use pre-trained Word2Vec or GloVe embedding. Check our lab tutorial on transfer learning using Word2Vec. You can also read these sample code using GloVe:
 - <https://machinelearningmastery.com/use-word-embedding-layers-deep-learning-keras/>
 - https://keras.io/examples/nlp/pretrained_word_embeddings/
- Make sure you load images in the same order as they are represented in the labeled set so all the labelled tweets match their corresponding images.
- You must use EarlyStopping when training neural networks using Tensorflow.
- You DO NOT need to do the hyper-parameter tuning.
- Print out Recall, Precision, and F1 score on test data for real and fake news, respectively.

5. Grading Breakdown

You may feel this project is described with some certain degree of vagueness, which is left on purpose. In other words, **creativity is strongly encouraged**. Your grade for this project will be based on the soundness of your design, the novelty of your work, and the effort you put into the project.

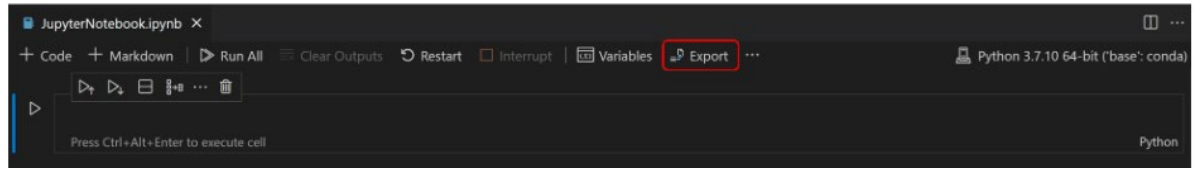
Use [the evaluation form on Canvas](#) as a checklist to make sure your work meet all the requirements.

6. Teaming

Students must work in teams of 2 people. Think clearly about who will do what on the project. Normally people in the same group will receive the same grade. However, the instructor reserve the right to assign different grades to team members depending on their contributions. So you should choose partner carefully!

7. Deliverables

- (1) The **HTML version of your notebook** that includes all your source code. In VS Code, you can export a Jupyter Notebook as an HTML file. To export, select the Export action on the main toolbar. You'll then be presented with a dropdown of file format options.



- (2) **Your report in PDF format**, with your name, your id, course title, assignment id, and due date on the first page. As for length, I would expect a report with more than one page. Your report should include the following sections (but not limited to):

- Problem Statement
- Methodology
- Experimental Results and Analysis
- Task Division and Project Reflection
- Additional Features

In the section “Task Division and Project Reflection”, describe the following:

- who is responsible for which part,
- challenges your group encountered and how you solved them
- and what you have learned from the project as a team.

In the section “Additional Features”, you describe and claim credit for additional features.

To submit your notebook and report, go to Canvas “Assignments” and use “Project 2”.

All the deliverables must be submitted **by team leader** on Canvas before

3:00 pm, Monday, March 27, 2023

NO late submissions will be accepted.

8. Possible Additional Features (5 pts per feature, 10 pts at most)

- Can you try transfer learning for the CNN input channel? <https://keras.io/api/applications/>
There are some models you may want to consider (try at least one model as listed here)
 - VGG16

- ResNet50
- MobileNetV2

- Try playing with another dataset: [Fakeddit](#). Here is a paper using this dataset for you to read. <https://link.springer.com/article/10.1007/s10844-022-00764-y>
- Try contextual word embedding like BERT to represent the text (tweets). Here is a nice introduction: <https://mccormickml.com/2019/05/14/BERT-word-embeddings-tutorial/>
High-level implementation: <https://www.sbert.net/docs/quickstart.html>
Low-level implementation: <https://huggingface.co/bert-base-uncased>

9. In-class Presentation.

On the due day, each team has 5 minutes to present your work in the class. Explain your solutions by referring to your notebook. You do not have to prepare the PowerPoint slides for your presentation.