Hello everyone. We are group 19. This presentation is about social media sentiment analysis on the war of Ukraine against Russia.

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Sentiment analysis is an important tool for identifying feelings in human natural language.

In this work, we use sentiment analysis to gain insights into public opinions about Ukraine’s war against Russia using data sources from social media platforms.

Our sentiment analysis has enabled us to provide recommendations to Ukraine on how it can enhance its international presence and improve its image.

I will briefly talk about sentiment modeling before delving into topic analysis and concluding with recommendations.

We have trained **4 basic machine learning models** and **A** **3-layer feedforward neural network classifier** as baseline models for sentiment classification.

The models are trained on a dataset that contains **5 hundred thousand** ***random*** tweets and we performed data cleaning and processing including language detection using the spacy package, text vectorization using TFIDF and bag of words and finally chi square-based feature selection.

with the processed data, we train the baseline models mentioned previously with a 5-fold cross validation together with grid search in order to determine the optimized hyperparameters for each model.

We have achieved above 0.95 accuracy for multiple models. We further evaluate the models’ performance based on checking **Receiver Operating Characteristic curve**, **precison recall** curve as well as **confusion matrix**.

The dataset we mainly studied in this work contains 270 thousand Reddit posts and comments related to Russia-Ukraine War. We validate the baseline models on this dataset and compared the predicted labels with those generated by VADER, a sentiment analysis tool commonly used in industry.

In order to ensure the accuracy and reliability of the sentiment analysis, we generate sentiment labels using another model based on DistilBERT, which employs the state-of-the-art BERT architecture. We compare the predicted labels generated by DistilBERT-based model and VADER. While there are some differences in identifying neutral sentiment, the number of opposite labels is minimal, as shown by the confusion matrix.

While the above sentiment classifiers are limited to generating positive, negative, and neutral labels, human emotions are far more complex. In order to capture the full range of human emotions, we train a multi-label classification model that is capable of detecting the eight primary emotions defined in Plutchik's Wheel of Emotions. (including

anger, anticipation joy trust fear surprise sadness and disgust as well as three extra labels of optimism pessimism and love. This model is based on NVIDIA’s previous research on sentiment discovery, where they have used **the original Transformer architecture** and we are able to improve their prediction using a BERT-based model.

For identifying factors and topics, we use the BERTopic which has been shown to outperform old topic identification models for example LDA.

Through performing hierarchical clustering, we are able to obtain topic clusters that is very helpful for studying factors of sentiment and emotions of each comment. The figure shown on the right-hand side are the top 40 impactful topics and their clusters.

We implement the sentiment analysis models and the topic identification model BERTopic to look into the Reddit posts about Russia Ukraine War. In the following several slides I am going to show our analysis on some hot topics.

For these comments under the topic pray for Ukraine, we are able to see high percentage of joy and optimism. While “Anger” and “disgust” emotions are still above 20% ,this is mainly because some people are expressing negative feelings about the war.

We also see very touching posts about Ukrainian heroes and The prevalence of the ”love” and ”optimism” emotions suggests that these sentiments drives a majority of individuals to believe Ukraine will emerge victorious.

Percentage of sadness is high in comments about civilians and casualties.

And apparently most individuals are afraid of the possibility of a nuclear war.

We also see bad sentiments in these comments on countries aligned with Russia.

Also we make this bidirectional barplot for visualizing people’s attitude towards different countries. While Russia is hated by the most. Germany also received very bad comments probably because they had been reluctant to offer solid military support to Ukraine. NATO alliance are also disliked by many people mainly because they have declined Ukraine’s request of joining them a couple of times.

Although not presented here, the models we developed are capable of performing comprehensive analysis on various topics such as weapons, war updates, and notable politicians.

Based on the analysis of reddit posts and comments, we suggest the following recommendations for the Ukrainian government.

First it is important to Focus on humanitarian aid and support the victims of the conflict: Countries that are reluctant to support Ukraine tend to receive negative sentiment. Thus, the government of Ukraine can demonstrate its commitment to helping those affected by the war by providing support to refugees, families of soldiers, and other vulnerable populations. This can include providing financial assistance, medical care, and psychological support.

Ukraine can also ask international NGOs for support. This will enhance the public image of both Ukraine and these international NGOs because it shows their strong standpoint toward Russia’s inhumane behavior.

Also, Ukrainian government should highlight the resilience and bravery of the Ukrainian people: Despite the difficult circumstances, Ukrainians have shown remarkable strength and determination in the face of adversity. Journalists should report more on the events of Ukrainian war heroes in order to inspire the military and influence people around the world to pay attention to the war. And this will help to gain more international support.

In conclusion, voicing up on online platforms like Reddit and Twitter can be beneficial for Ukraine. Together, we can help Ukraine to uphold the principles of democracy and sovereignty that are essential for a peaceful and prosperous world.