Multimodal Sentiment Analysis of Tamil and Malayalam

Abhinav Patil, Sam Briggs, Tara Wueger, D. D. O'Connell

Task Description

The Shared Task

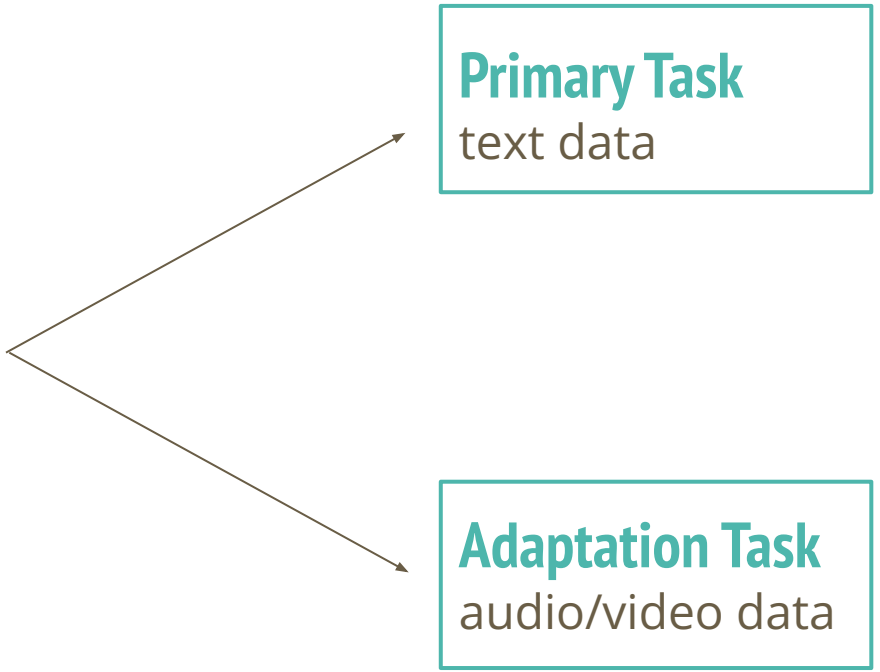
Multimodal Abusive Language Detection and Sentiment Analysis:
DravidianLangTech@RANLP 2023 shared task hosted on CodaLab

two multimodal (text, audio, video) subtasks:

1. abusive language detection in Tamil
2. **sentiment analysis in both Tamil and Malayalam**

The Shared Task

- categorize data into 5 different categories
  - Highly Negative
  - Negative
  - Neutral
  - Positive
  - Highly Positive
- distances between the categories are taken to be unknown or not well-defined



Core Approach

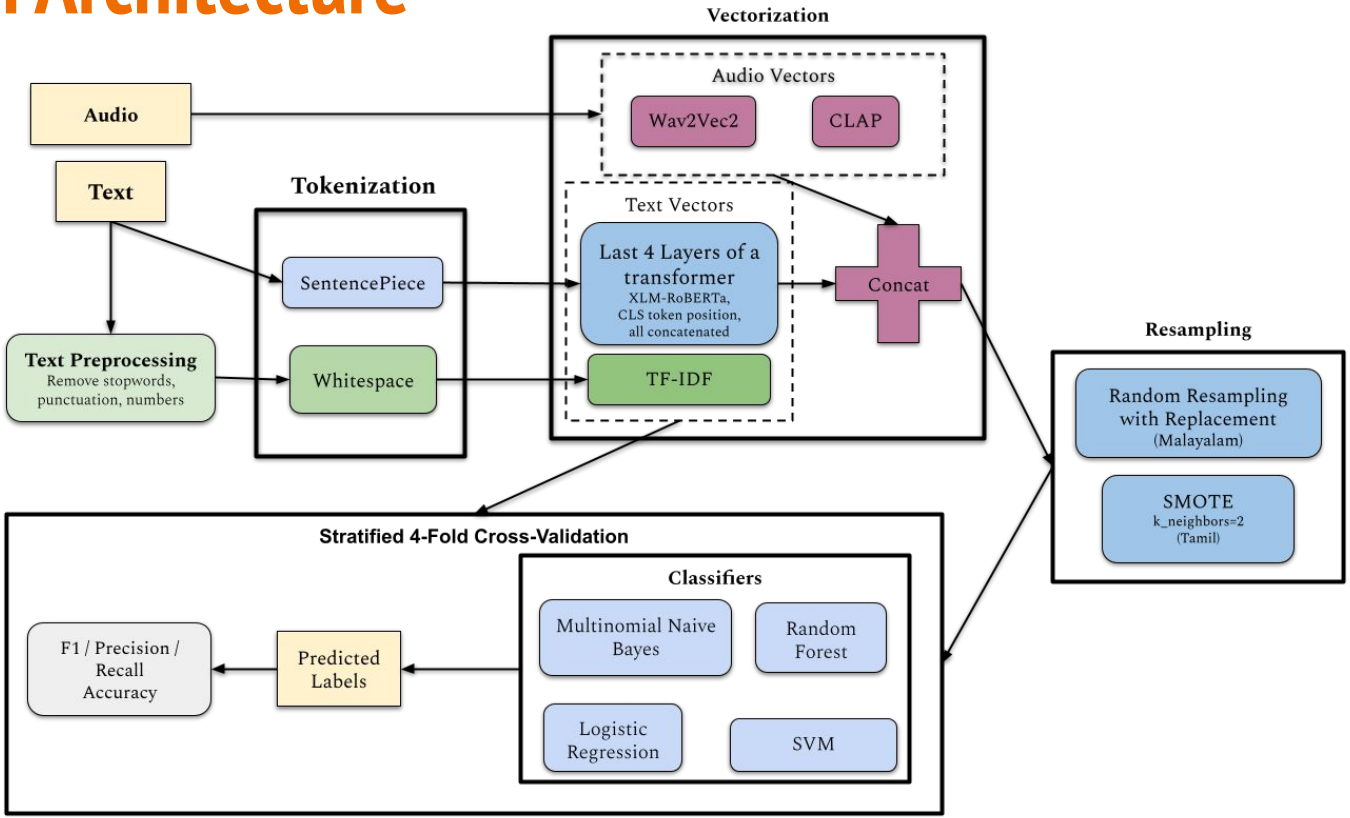
D2 Baselines

- Simple baseline
  - Preprocess- strip punctuation, numbers, whitespace tokenize, TF-IDF document embedding
- Finetuned transformers
  - Finetune a classification head for various transformer LMs on our dataset
    - We tried indic-bert, XLM-RoBERTa, and mBERT
- All performed as well as a simple majority class classifier- i.e. they classified all instances as positive

Last Four Layers of XLM-RoBERTa

- Tokenize document using XLM-RoBERTa SentencePiece tokenizer
  - truncate or pad to 512 tokens
- Pass through XLM-RoBERTa
- Get last four hidden layer matrices
- Get the first row of each of the four matrices- CLS token embedding
- Concatenate them together
- Additional vector transformation (e.g. SMOTE)
- Pass to a classifier

System Architecture



Results

D3 Results - (XLM RoBERTa layers)

Majority Class Baseline	Macro Precision	Macro Recall	Accuracy	Macro F1
Tamil	.12	.20	.61	.15
Malayalam	.12	0.20	0.60	0.15/0.15

Logistic Regression	Macro Precision	Macro Recall	Accuracy	Macro F1
Tamil (SMOTE)	0.29	0.34	0.28	0.26
Malayalam (no SMOTE)	0.12	0.20	0.60	0.15

Random Forest	Macro Precision	Macro Recall	Accuracy	Macro F1
Tamil (SMOTE)	0.22	0.21	0.57	0.19
Malayalam (no SMOTE)	0.22	0.21	0.60	0.18

Issues + Successes

Error Analysis

- Very small Dataset!
  - Tamil: **54** train/dev instances
  - Malayalam: **60** train/dev instances
- Imbalanced Dataset!
  - Tamil: **4** Highly Negative, **4** Negative, **6** Neutral, **33** Positive, **7** Highly Positive
  - Malayalam: **10** Highly Negative, **1** Negative, **6** Neutral, **36** Positive, **7** Highly Positive
    - The single negative examples means that, strictly speaking, for most of the k-folds, F1 is entirely undefined; by default, we use a negative class F1 of zero if there are not any true positives for the negative class in the given fold validation set, meaning the maximum achievable macro F1 is .8
- Next Steps:
  - Try other rebalancing techniques (ADASyn, EDA,AEDA)
  - SMOTE isn't possible for Malayalam out-of-the-box due to only one negative sample- other strategies possible?
  - Hyperparameter tuning for our classification models
  - Try different types of feature vectors/document embeddings
  - Audio vectors

References

Premjith B., Sowmya V., Joyithish Lal. G., Bharathi Raja Chakravarthi, K. Nandhini, Rajeswari Natarajan, Abirami Murugappan, and Bharathi B. 2023. Multimodal Abusive Language Detection and Sentiment Analysis: DravidianLangTech@RANLP 2023.

Bharathi Raja Chakravarthi, Ruba Priyadharshini, Vigneshwaran Muralidaran, Shardul Suryawanshi, Navya Jose, Elizabeth Sherly, and John P. McCrae. 2021. Overview of the track on sentiment analysis for dravidian languages in code-mixed text. In *Proceedings of the 12th Annual Meeting of the Forum for Information Retrieval Evaluation*, FIRE '20, page 21–24, New York, NY, USA. Association for Computing Machinery.

Jingfeng Cui, Zhaoxia Wang, Seng-Beng Ho, and Erik Cambria. 2023. Survey on sentiment analysis: evolution of research methods and topics. *Artificial Intelligence Review*.

Giovanna Maria Dimitri. 2022. A short survey on deep learning for multimodal integration: Applications, future perspectives and challenges. *Computers*, 11(11).

Olivier Habimana, Yuhua Li, Ruixuan Li, Xiwu Gu, and Ge Yu. 2019. Sentiment analysis using deep learning approaches: an overview. *Science China Information Sciences*, 63(1):111102.

Cees GM Snoek and Marcel Worring. 2005. Multimodal video indexing: A review of the state-of-theart. *Multimedia tools and applications*, 25:5–35.