Advanced Cyberbullying Detection using modern bert

PRESENTED BY

Dhanush Gowda HM (4PS21IS015)

Hemashree SS (4PS21IS021)

Sumanth M (4PS21IS053)

Vaishnavi C (4PS21IS056)

GUIDED BY

Suresh MR

Associate Professor

Dept. of IS&E

PESCE, Mandya

OVERVIEW

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PROBLEM STATEMENT

Advanced Cyberbullying Detection using ModernBERT

Cyberbullying has become a significant issue due to the rise of social media and digital communication platforms. Traditional cyberbullying detection systems often focus solely on text-based content, failing to account for multimedia elements such as images and emojis. This limitation reduces the accuracy and effectiveness of these systems in identifying and mitigating cyberbullying incidents. The need for an advanced system that integrates both textual and visual content analysis is critical for improving cyberbullying detection accuracy.

OBJECTIVES

1. detect harmful or offensive language on online flatforms (gaming and social media), making online spaces safer .
2. To create a reliable system that can automatically flag potential cyberbullying by analyzing not just text, but also emojis and images, making detection more efficient and thorough
3. To achieve a model accuracy of above 90%, and compare with existing systems.

SYSTEM ARCHITECTURE

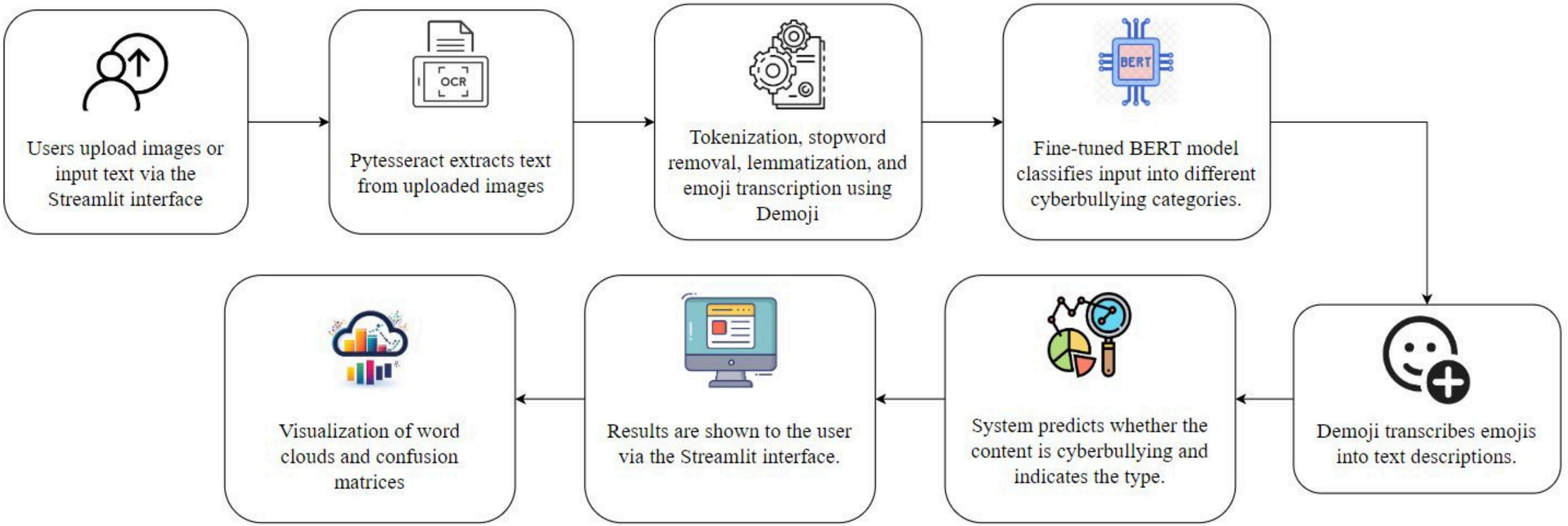
High-Level System Design

1.**Data Preprocessing Module:** Extracts text from images using Pytesseract, removes noise, and processes emojis.
2.**Feature Extraction Module:** Uses demoji and NLP techniques to extract relevant features from text.
3.**Machine Learning Model:** Fine-tuned BERT model for classifying content as cyberbullying or non-cyberbullying.
4.**Prediction and Visualization Module:** Integrates with Streamlit to display results in an interactive interface.

Low-Level System Design

1. **Text Processing Layer**: Tokenization, stemming, and stopword removal.
2. **Visual Content Analysis Layer**: Image OCR and emoji transcription.
3. **Deep Learning Model**: Fine-tuned BERT classifier.
4. **Result Interpretation and API Layer**: Displays predictions and logs results.

SYSTEM ARCHITECTURE



MODULES DEVELOPED AND THEIR FUNCTIONALITIES

1. **Data Collection Module** – Captures text and image-based content for analysis.
2. **Text Processing Module** – Cleans, tokenizes, and prepares text for analysis.
3. **Image Analysis Module** – Extracts text from images using Pytesseract.
4. **Emoji Processing Module** – Converts emojis into text for sentiment analysis.
5. **Machine Learning Module** – Uses a fine-tuned BERT model for classification.

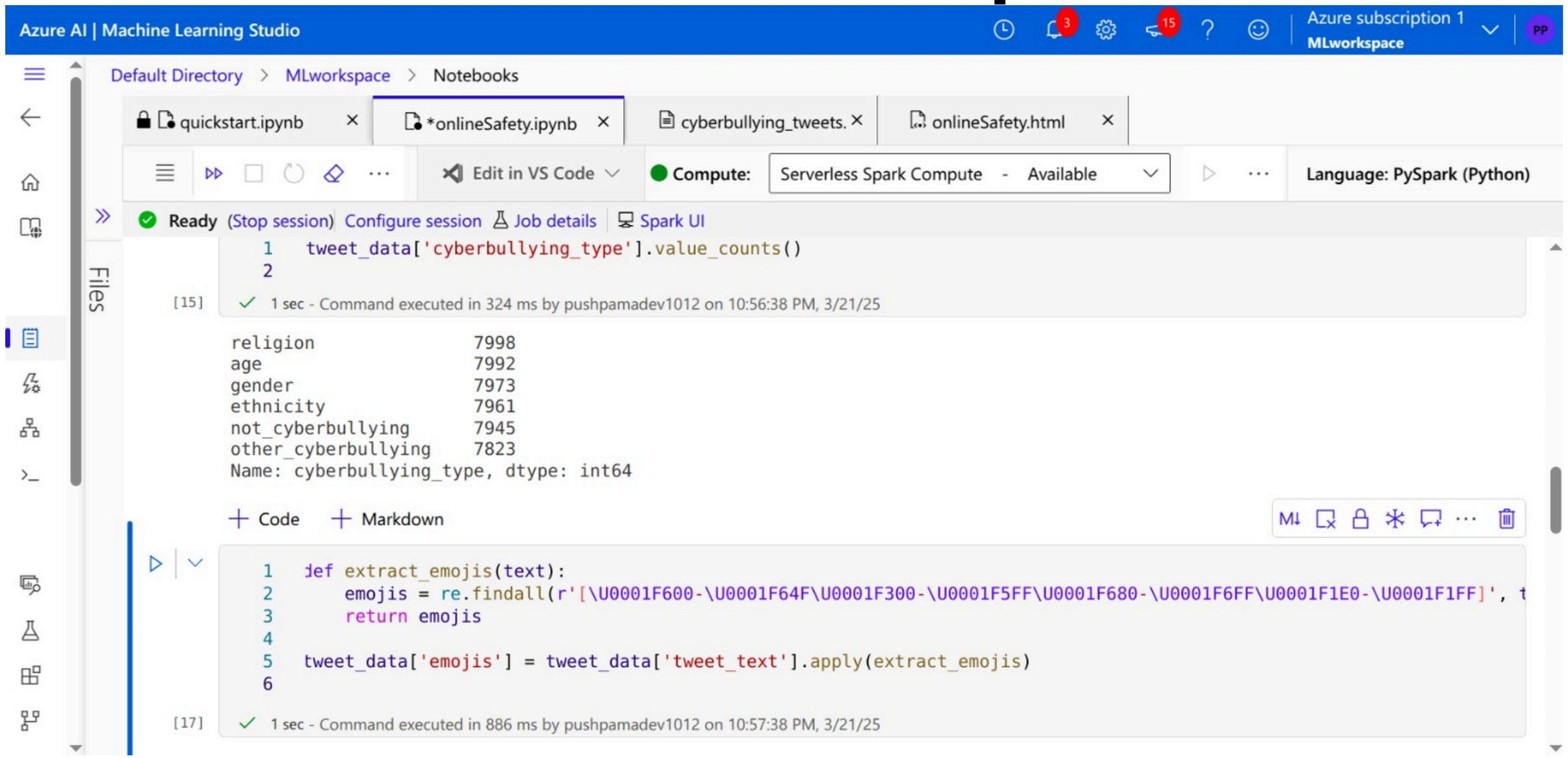
TOOLS AND TECHNOLOGIES USED

Component	Technology Used
Programming Language	Python
Machine Learning Frameworks	TensorFlow, PyTorch, Scikit-learn
NLP Tools	NLTK, Transformers (BERT)
OCR and Image Processing	Pytesseract, PIL
Web Interface	Streamlit
Data Processing	NumPy, Pandas
Visualization	Matplotlib, Seaborn
Network Traffic Analysis	Scapy, Wireshark

CHALLENGES AND SOLUTION

1) Handling emojis in cyberbullying detection
Solution: Integrated emoji library for emoji-to-text conversion, enhancing sentiment analysis and overall detection accuracy.
2) low software resource
solution: used Azure cloud for computing power
3) Noise and irrelevant symbols in tweets
Solution: Used regular expressions and text cleaning techniques to remove unnecessary symbols, links, and mentions (like @user, #hashtags).

Azure machine learning workspace with serverless compute



RESEARCH PAPER LINK

https://docs.google.com/document/d/1QQW5zdNZ2Eaue8r2M2dU_bN0uqr8xldNoG0QpgxWtw4/edit?usp=sharing

THANK YOU