**Detecting Dark Patterns in E-commerce Websites using Pre-trained BERT Model and Flutter-Based Mobile Application**

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As e-commerce continues to expand, the rise of dark patterns—subtle design strategies intended to manipulate user behaviours—poses a growing concern. Traditional methods for detecting these deceptive practices, such as manual inspection or rule-based algorithms, often prove inadequate due to their laborious nature and susceptibility to oversight. To address these limitations, we propose a different approach adapting machine learning and mobile technology. By employing advanced computational techniques, we aim to develop a more efficient and accurate method for identifying and combatting dark patterns in online environments.

This project presents a comprehensive methodology for training and testing a model designed to identify dark patterns on e-commerce websites. Leveraging the BERT pre-trained model, we fine-tuned it using a custom dataset curated to encompass a diverse range of dark patterns prevalent across e-commerce platforms. Our dataset, consisting of over 2000 instances of documented dark patterns data, facilitated effective training of the model. To support the training process, we utilized essential Python libraries such as `transformers` for importing the pre-trained BERT model, `datasets for dataset handling and preprocessing, and `pyarrow` for accelerating pandas IO reading capability. Additionally, `hugging face hub` was instrumental in managing model and tokenizers seamlessly, while `pandas`, `matplotlib`, `seaborn`, and `NumPy` were employed for data manipulation, visualization, and analysis.

Auto tokenizers tailored for 'BERT-cased models' were employed to tokenize input text, enabling the model to process textual data efficiently during both training and testing phases. Upon completion of the training process, our model demonstrated an impressive accuracy of 96% and a loss of 0.1296, indicating its effectiveness in accurately identifying and classifying dark patterns.

To ensure practical applicability, we developed a user-friendly mobile application using Flutter for the frontend and Flask for the backend, facilitating seamless interaction and deployment. Web scraping techniques, augmented using 'Puppeteer', were employed to gather additional data for further model refinement. Additionally, we integrated an open-source generative AI model from Hugging Face to continually enhance the model's performance and robustness by augmenting the training dataset with newly discovered instances of dark patterns.

In conclusion, our solution offers a comprehensive approach to training and testing a BERT-based model for identifying dark patterns on e-commerce websites. By leveraging Modern technologies and techniques, including BERT pre-training, fine-tuning, Auto tokenizers, web scraping with Puppeteer, and integration of generative AI, our project provides an effective solution for combating deceptive design practices in the online commerce platforms.

**Keywords:** Bert, Machine learning, Flutter, hugging face transformers, Puppeteer, Web scraping.

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**IMAGES OF OUR PROTOTYPE OUTPUT:**

**A screenshot of a computer

Description automatically generated**