उपभोक्ता मामले विभाग
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Dark Patterns Buster Hackathon 2023

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Dark Patterns Buster Hackathon (DPBH-2023)

BANNARI AMMAN INSTITUTE OF TECHNOLOGY
Stay Ahead

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IDENTIFY HIDDEN COSTS AND DARK PATTERNS

Abstract:

This project focuses on enhancing transparency and empowering online consumers through a suite of **Chrome Extension** and **Web Application** designed to address common issues encountered during online shopping. The **Hidden Cost Identifier**, **Dark Pattern Highlighter**, and **Analyzer** aim to reveal obscured charges, flag manipulative design techniques, and analyze deceptive patterns, respectively. Additionally, the **Price Comparison** Functionality enables easy product price comparison across platforms, while a Customer **Chatbot** offers support to enhance the overall shopping experience. **These components promote transparency, autonomy, and informed decision-making in the online marketplace.**

Impact Assessment & Conclusion:

Our solution addresses common challenges in online shopping by providing **Web Application** and **Chrome Extension** to expose hidden charges, deceptive design tactics, and price variations across platforms. By boosting user **awareness**, **protection**, and **trust**, it contributes to a fairer digital marketplace. Continuous refinement is crucial to stay ahead of emerging **threats in the online retail environment**.

Solution Highlights:

- Utilizes advanced models such as the **Bert model** in Python **and Playwright** for real-time detection of hidden costs and dark patterns.
- Enables informed decisions through thorough **analysis and comparison capabilities** across platforms.
- Promotes **fairness and ethics, benefiting consumers** and fostering a **reliable** digital marketplace.

Uniqueness:

Leveraging **Playwright for through data gathering** and a sophisticated **Bert model** in Python sets our solution apart, ultimately empowering consumers with informed decision-making in online shopping.

Technology Stack:

Main Features

Our solution consists of three key features:

1. **Hidden Cost Identifier:** This feature identifies any extra charges that might not be obvious during online shopping. We utilize **Playwright** to calculate hidden costs on the

checkout page, comparing them with the main webpage to display the obscured charges in the extension, thereby identifying and highlighting hidden costs to provide clarity to users.

2. **Dark Pattern Highlighter:** The Dark Pattern Highlighter points out any sneaky or deceptive tactics used on websites. It detects and flags manipulative design techniques, helping users navigate digital interfaces with awareness.
3. **Dark Pattern Analyzer**: This component examines websites for patterns designed to manipulate or deceive users, providing insights into their presence. By analyzing website elements and user interactions, it offers valuable information to empower users in making informed decisions.

Additional Features

In addition to the core features mentioned above, our solution offers the following additional features:

Price Comparison Functionality: Facilitates easy comparison of product prices across platforms, empowering users to make informed purchasing decisions.

Customer Chatbot: Offers support to online consumers, enhancing their overall shopping experience by providing real-time assistance and guidance.

These additional features further enhance user protection and experience, promoting transparency and autonomy in online shopping.

Process Flow Explanation

The process flow of our solution is as follows:

1. **User Interaction:** Users interact with the browser extension and application while browsing online.
2. **Input Collection:** The system collects data from the user's browsing activity, including text data from visited websites.

3. **Analysis:** Advanced **algorithms** and **models** and also **mathematical calculation** to analyze the collected data to detect hidden costs and dark patterns.
4. **Output Presentation**: Detected hidden costs and dark patterns are presented to the user **through alerts, visualizations, or explanations**, empowering them to make informed decisions.

ML Model In-Depth

Our solution leverages sophisticated machine learning models, particularly the **Bert model**, for dark pattern detection. Below is an in-depth overview of the **ML model architecture, data handling**, and improvements made to enhance dark pattern detection:

Model Overview:

- The Bert model stands for **Browser Extension-based Transformer**. It is a custom-built transformer model tailored specifically for detecting dark patterns in online shopping interfaces.
- Inspired by BERT (Bidirectional Encoder Representations from Transformers), the Bert model is pre-trained on a large corpus of labeled dark pattern data to learn representations of text sequences and their associated patterns.

Architecture:

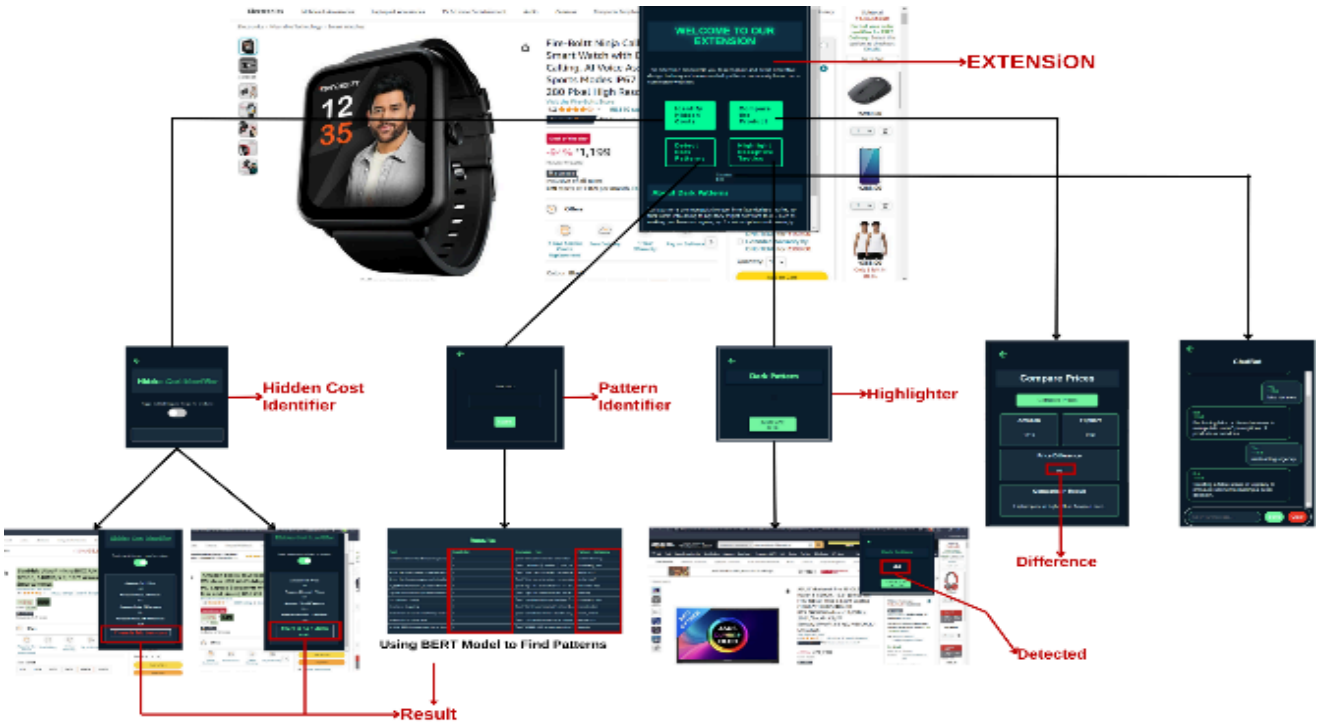
- The Bert model architecture comprises multiple layers of transformer blocks, each consisting of **self-attention mechanisms and feedforward neural networks.**
- The model takes text data extracted from web pages as input and processes it through multiple layers to capture contextual information and semantic relationships between words.

- Unlike traditional BERT models, the Bert model is optimized for processing web page content, incorporating features such as **HTML tag embeddings and browser-specific tokenization.**

Data Handling:

- Training data for the **Bert model consists of a diverse dataset of labeled** examples of dark patterns extracted from various online shopping websites.
- The data undergoes extensive preprocessing, including HTML parsing, text extraction, and labeling of dark pattern instances.
- **Text data is tokenized and encoded** into numerical representations suitable for input to the transformer model.

Extension Work-Flow :



Improvements:

- To enhance **dark pattern detection accuracy**, several improvements have been made to the Bert model architecture and training pipeline.
- **Fine-tuning techniques**, such as adversarial training and domain-specific regularization, are employed to adapt the model to the nuances of online shopping interfaces.
- Transfer learning from domain-related tasks, such as **sentiment analysis and product classification**, helps the model learn relevant features for dark pattern detection.
- Continuous monitoring and **evaluation of model performance** allow for iterative improvements and fine-tuning of hyperparameters to achieve optimal detection results.

By employing the Bert model and incorporating domain-specific optimizations, **our solution achieves high accuracy in detecting various types of dark patterns**, thereby empowering users with the insights needed to make informed decisions while shopping online.

Deployment Architecture

Our solution is deployed as a browser **Extension** and **Web Application**, ensuring scalability for multiple users and requests. We utilize leveraging services such as **github for containerized deployment**. Orchestration tools are used to manage containers efficiently, ensuring real-time detection capabilities.

Result:

Our solution offers valuable insights and analysis, **promoting fairness and ethics, benefiting consumers, and fostering** a more reliable digital marketplace.