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Privacy Preserving Methodology to Empower Users to Understand Terms of Service Agreements Adelheid Spantzel

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Abstract

Terms of Service (ToS) agreements are widely accepted without being read, leading to privacy risks and loss of user rights. A Deloitte survey found that 91% of users do not read these agreements [1]. This work presents an Al-powered tool that simplifies ToS agreements and prioritizes key clauses. Unlike cloud-based solutions, it operates entirely on local devices, preserving privacy while enhancing user awareness.

Problem Statement

Users frequently ignore ToS agreements due to length and complexity [2].



Implementation Overview:

Summarization Model: BART-based transformer reduces lengthy agreements into



- Important clauses related to privacy, data sharing, and arbitration often go unnoticed [3].
- Existing solutions, such as Terms of Service; **Didn't Read (ToS;DR)**, rely on manual annotations and cloud-based processing, raising privacy concerns [4].

How can we provide an automated, private, and user-friendly method to analyze ToS agreements effectively?

Approach and Design Objectives:

- **Security:** All processing happens locally to protect user data and ensure tamperproof evaluation if the device is not compromised.
- **Privacy:** No cloud-based transmission ensures sensitive information stays on the user's device.
- **Correctness & Accuracy:** Uses fine-tuned Natural Language Processing (NLP) models trained on legal documents [5].
- **Efficiency:** Optimized for real-time summarization with minimal computational overhead [6].
- **User Experience:** Presents an easy color-coded, structured summary highlighting key clauses.

concise insights.

- **Question-Answering Model**: Al extracts relevant answers from ToS agreements.
- **Classification Model**: NLP classifies clauses into risk categories.
- **User Interface**: Displays results in color-coded summaries for quick understanding.

Key Findings:

- **92% of critical clauses** were successfully identified by the tool.
- **90% accuracy** in summarizing moderately important information.
- 56% of hidden clauses (e.g., arbitration or data-sharing policies) were surfaced.



Algorithmic Workflow:

- **1. Extract ToS text** from webpage or clipboard.
- 2. Preprocess text (tokenization, stopword removal, segmentation).
- **3. Summarize content** using facebook/bart-large-cnn NLP model.
- **4.** Classify clauses into three risk levels:
 - **Green:** Informational clauses.
 - 2. **Orange:** Important clauses.
 - 3. **Red:** Critical clauses (e.g., data sharing, arbitration).
- 5. Answer user queries using deepset/roberta-base-squad2.
- 6. Display structured output with an interactive interface.

Terms of Service Summary Al-Generated Summary of Terms of Service:

Color Code Legend:

Green: Not alarming Orange: Moderate importance Red: Highly alarming

Data Collection Practices: biometric data

Data Sharing and Third Parties: advertising partners

User Responsibilities and Restrictions: Users must provide accurate information when creating an account

Liability and Dispute Resolution: Refunds are not available except where required by law

OK

Implementation Screenshot of ToS Analysis Tool.

Advantages

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- **Real-Time Monitoring & Clipboard Integration:** Tool automatically detects and processes ToS agreements while browsing. Users can manually paste text for on-demand analysis.
- Local AI Processing: Eliminates privacy risks associated with cloud-based solutions. Uses ONNX runtime and TensorFlow Lite for fast, offline execution.
- **Output and Prioritization:** Presents results in a structured, color-coded summary. Risk-scoring mechanism helps users assess overall exposure to unfavorable terms.
- Holistic Graph Analysis: Distribution of ToS Risk Levels Across Popular Services to understand the lay of the land.

Future Work

- Adaptive Learning: Improve AI detection with real-time updates.
- Expanded Language Support: ToS for non-English agreements.
- Integration with Conversational AI: Allow interactive Q&A.
- OCR Support: Extract ToS terms from images and PDFs.

References [1] Deloitte, "91% of Consumers Don't Read Terms of Service Agreements," 2017. [2] Federal Trade Commission, "Data Collection Practices in ToS Agreements," 2019. [3] P. McNamara, "Measuring Legal Text Readability," 2009. [4] M. Lippi, "Automatic Contract Review Using NLP," 2019. [5] G. Harkous, "Polisis: Al-Driven Privacy Policy Analysis," 2018.



