A novel approach for Medical E-Consent: Leveraging Language Models for Informed Consent Management

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Context

Informed consent in healthcare reflects the principles of individual autonomy and ethical treatment. The process of obtaining consent from patients is complex, influenced by various factors such as age, socio-economic status, and evolving medical technologies. Compliance with legal frameworks, such as the 'Kouchner Law,' underscores the necessity for patient autonomy in healthcare decision-making.

"No medical procedure or treatment can be performed without the free and informed consent of the individual, and this consent can be withdrawn at any time."

Contributions

- Introduction of a comprehensive and adaptive approach to informed medical consent.
- Proposition of knowledge graph and LLM combination to elevate patient communication and comprehension.
- Development of a personalized e-consent system based on literacy level and language, enhancing the informed consent process.

LLM-based E-Consent approach

I/ Data acquisition and processing : This component oversees core datasets and associated processing, based on offline mapping of consent documents to legal articles.

II/ Personalized e-consent : This component personalizes consent forms by leveraging LLM to refine, rephrase, and summarize content based on the patient's information stored in the knowledge graph.

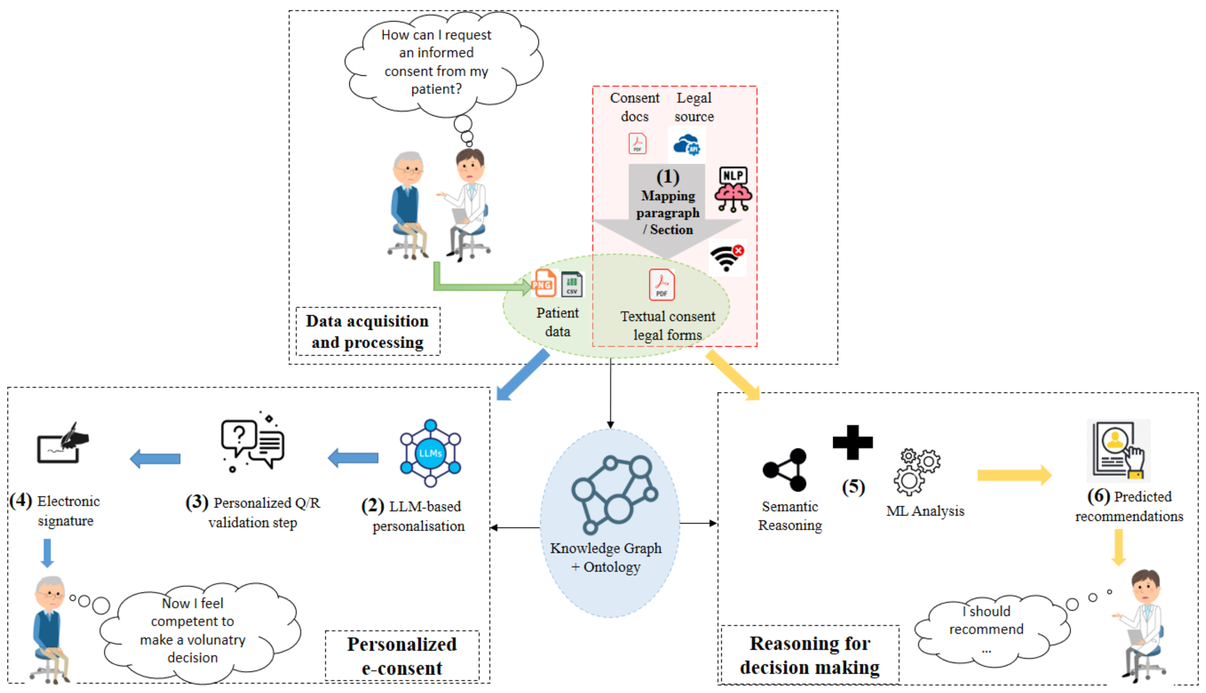


Figure: LLM-based e-consent approach (1)

(1) Mouncef Naji, Maroua Masmoudi, Hajer Baazaoui, A novel approach for Medical E-Consent: Leveraging Language Models for Informed Consent Management. In Intelligent Information and Database Systems. (ACIIDS), 2024

III/ Reasoning for decision making : This component plays a role in aiding medical professionals in selecting the most suitable interventions for a patient. Its based on ontologies and knowledge graph for reasoning, and decision trees for recommendations.

Use case

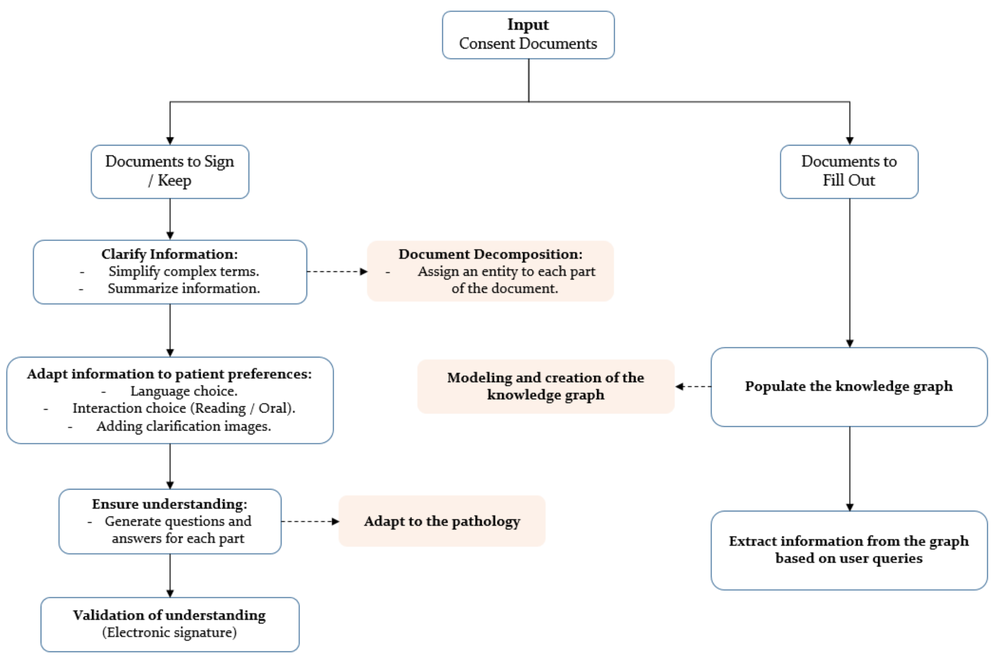
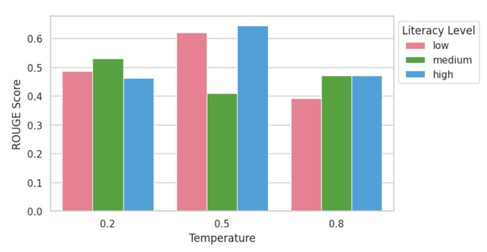


Figure: LLM-based e-consent process scenario

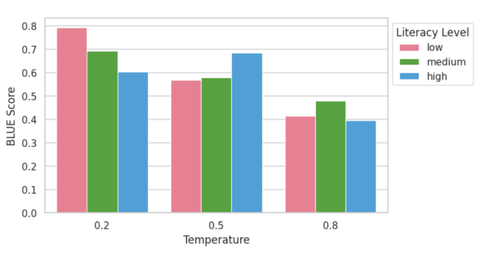
Experiments

Data: The consent forms in PDF format and the Patient's personal data.
Models : LLM (Chat-gpt), Langchain (retrieval augmented generation).
Factors : Literacy level, Language, LLM's temperature.
Metrics:

- ROUGE : (Recall-Oriented Understudy for Gisting Evaluation), evaluates the quality of summaries of text generation.
- BLUE : (Bilingual Evaluation Understudy), evaluates the quality of machine-generated translations.



(a) ROUGE Scores (generated text)



(b) BLUE scores (Translated text)

Figure: Rouge and Blue scores for different literacy levels at different temperatures

Results :

- (a) The similarity is good but not perfect, showcasing that there is a certain similarity between the input and the output, but still personalized on the literacy level.
- (b) There is a commendable level of similarity between the input and output texts. However, the scores fall short of perfection, indicating room for personalization, alligned with the user's literacy level.

Conclusion

- Introduction of a comprehensive approach to informed medical consent using knowledge graphs, LLM, and semantic reasoning.
- Focus on the personalized e-consent to enhance patient communication and comprehension.
- Overcoming limitations of existing solutions through robust semantic connections and accommodation of diverse patient needs.
- Emphasis on personalized e-consent component, focusing on experiments with literacy level and language variations, has shown room for content personalisation.

Perspectives

- Integration of decision-making components using decision trees and decision transformers to support a recommendation system.
- Training decision tree models to predict the most appropriate decisions for specific pathologies, further enhancing patient care and decision-making processes.