Designing a Method to Identify Explainability Requirements in Cancer Research

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The Need for XAI in AI for Cancer

Challenges in AI Deployment:

- Complexity of cancer: Multiple variables impacting progression.
- Heterogeneity of medical data from diverse sources.
- Transparency Issues:
 - Lack of understanding between input and model outcome.
 - Decision-making process remains unclear.

Building Trustworthy AI Tools for Cancer Care

INCISIVE [1] Project Goals:

- Enhance accuracy, specificity, sensitivity, interpretability, and costeffectiveness of AI in cancer imaging.
- Target cancers: breast, prostate, colorectal, and lung.
- Al Tools in Development:
 - Support clinical tasks: diagnosis, monitoring, prognosis.
 - Emphasis on Explainable AI (XAI) to foster trust among healthcare professionals.

The Gap We Aim to Address

Challenges with Explanations:

- Explanations can vary based on purpose, user, and scenario.
- Careless application can lead to unfavorable outcomes.

Designing for Target Users:

- Addressing concerns of oncologists, radiologists, researchers.
- Eliciting requirements for XAI in a specific domain to foster trust and usability.

The procedure and material

Understanding HCPs' Requirements:

• Utilized two scales: Explanation Goodness Checklist and Explanation Satisfaction Scale [2].

Explanation Goodness Checklist:

• Evaluates the quality of explanations: clarity, completeness, coherence.

Explanation Satisfaction Scale:

- Collects judgments from participants who've worked with the XAI system.
- Assesses user satisfaction with the explanations provided.

Circulating the Questionnaire

- Creation and Distribution:
 - Based on internal discussions and workshops within the INCISIVE project.
 - Aimed to gather comprehensive data on XAI methods from HCPs.
 - Questionnaire Structure:
 - Context, participant background, preferred information types, and presentation styles.
- Feedback Collection:
 - Encouraged multiple responses per institution.
 - Followed up and analyzed responses for insights on explainability.

Questionnaire Responses (overview)

- Total responses: 11
- User preferences: Certainty of diagnosis and supporting evidence.

Please select your areas of expertise Do you have any additional comment on your areas of expertise?

0	Lung cancer	NaN
1	Lung cancer	NaN
2	Prostate cancer	Multiparametric prostate MRI
3	Prostate cancer;Breast cancer	NaN
4	Breast cancer	internist specialized in diabetes
5	Breast cancer	NaN
6	Lung cancer;Breast cancer;Colorectal cancer	NaN
7	Lung cancer;Prostate cancer;Breast cancer;Colo	NaN
8	Prostate cancer	NaN
9	Breast cancer	NaN
10	Lung cancer	NaN

How certain this diagnosis/prognosis is	4.818182	
The information that supports the diagnosis	4.636364	
Patient information that is used to make diagnosis/prognosis		
The reason why this information is indicative of this diagnosis/prognosis	4.363636	
The reason why it is this diagnosis and not another one		
The information that would increase the certainty of the diagnosis	4.272727	
The information that contradicts the diagnosis		
A description of the condition		
Other diagnoses that are conceivable based on the case information		
The performance of the system for other, similar cases		
From what value of feature X the diagnosis would have been different		
The prevalence of the condition		
The likely diagnosis if feature X had not been A but B		

Questions

An AI model is able to perform classification, prediction, segmentation and so on. Below there is a list of information elements that could be provided as explanations. Please rate each one based on how important and useful you think it is to fulfill your goals

Results: Medical Image

- Highest scored method: LRP
- Level of agreement:
 - Strongly disagree
 - Disagree
 - Neutral
 - Agree
 - Strongly agree











3. This explanation lets me judge when I should trust and not trust the algorithm.



Results: Tabular data

- Highest scored method: LIME
- Level of agreement:
 - Strongly disagree
 - Disagree
 - Neutral
 - Agree
 - Strongly agree









Results overview



Visualizing Average Responses(score) Across Techniques in Relation to Each of the Following Three Statements:

- 1. This explanation of how the algorithm works is **useful to my** goals.
- 2. This explanation of how the algorithm works seems complete.
- 3. This explanation lets me judge when I should trust and not trust the algorithm.

User Feedback (data providers)

• Users want explanations to highlight both image and clinical features supporting diagnosis.

"In addition to the discriminating image features, the XAI should also provide the discriminating clinical features from the patient's medical record that support the diagnosis."

• One provider's understanding rating: 3 out of 5 - indicating room for improvement in explanation clarity

"I chose 3 - neutral since I did not completely understand the explanation model."

Evaluation of Results

- **Insights Gained**: Uncovered crucial insights into HCPs' interests and requirements regarding explainability.
- **Key finding:** Some HCPs had difficulty understanding the explanations.
- **Bridging the divide:** Complex nature of explainability and technical language pose challenges to HCPs without a technical background.

Final Insights

- Questionnaire may not be directly reusable for other projects.
- Methodology and structure can serve as a reference.
- Provides insights into healthcare professionals' needs for explainability in Al for cancer research.
- Systematic approach with transparency and user-centered design can be adapted for diverse contexts



Thank you!

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