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Enhancing Breast Cancer Recognition using Vision Transformer and Explainable AI

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Academic year: 2024/2025
Doctoral study period: 2024-2028

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CONTENT

Study plan and summary of their implementation:

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Year of study	Exams	
	Plan	Completed
I (2024/2025)	**2**	**1**
II (2025/2026)	2	
III (2026/2027)	0	
IV (2027/2028)	0	
Total:	4	1

Year of study	Participation in Conferences				Publications					
	International		National		With citation indicator			Without citation indicator		
	Plan	Completed	Plan	Completed	Plan	Completed	Condition	Plan	Completed	Condition
I (2024/2025)			**2**	**2**				**0**	**1**	**Published**
II (2025/2026)	1							2		
III (2026/2027)	1				1					
IV (2027/2028)	1				1					
Total:	3		2	2	2			2	1	

The plan for the reporting half-year and its implementation:

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Exams 2024/2025 (2nd semester)		
Plan	**Completion Date**	**Condition**
Research methods and methodology in computer science and computer engineering. (2025 y. II quarter)		Retake exam is scheduled for 25th September, 2025
Digital signal processing. (2025 y. II quarter)		Pass

The plan for the reporting half-year and its implementation:

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Conference participation 2024/2025 (2nd semester)		
Plan	Completed	Conference type
1	Authors: Dastgeer, S., Treigys, P. Poster Title: A Review of Transparent Breast Cancer Diagnostics with Explainable AI and Large Language Models Conference name:AIEEE 2025 Date: May 15-17, 2025 Location:Vilnius, Lithuania.	National

Publications 2024/2025 (2nd semester)			
Plan	Completed	Condition	Publication Type
1	DASTGEER, Sobia, and Povilas TREIGYS. "LLMs and XAI for Breast Cancer Transparency: A Review." Baltic Journal of Modern Computing 13.2 (2025). https://doi.org/10.22364/bjmc.2025.13.2.12	Published	University of Latvia: Baltic Journal of Modern Computing JIF:0.7, Q4

Information about international events and publications presenting the main results of the dissertation (articles with citation index only)

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Participation in international conferences	
	Description

Publications (with citation rate only)	
	Bibliographic description

Research object & Aim:

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Research object: Vision transformer and Large language model with Explainable Artificial Intelligence for breast cancer detection to enhance accuracy with transparency.

Aim: To develop and evaluate techniques used to improve Breast cancer detection using Vision Transformer and Large Language model with Explainable Artificial Intelligence.

Research Tasks:

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- Conduct a literature review which helps us to examine critical challenges and emerging advancements in breast cancer detection.
- Investigate and Implement current methods used for breast cancer detection using Vision transformer.
- Propose the technique to improve the breast cancer diagnostic accuracy with transparency using Large language model and Explainable Artifificial Intelligence.
- Compare the results of the proposed technique using different modalities (e.g. Mammography, Magnetic Resonance Imaging).

Stages of research and dissertation preparation:

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Title of the work		Deadlines	Notes
1	**Review and analysis of scientific research on the topic of the dissertation (in Lithuania and abroad):**		An initial review and analysis of scientific research was conducted.
	1.1. Specification of the research object of the dissertation.	October 2024 - March 2025	Studies with Explainable AI and vision transformer in breast cancer classification have begun. The significance of the topic was presented at the conference.
	1.2. An overview of Explainable AI techniques in Breast Cancer recognition.	October 2024 - September 2025	The overview of the study has been completed. The review paper has been published in a peer reviewed journal related to the LLMs and XAI for Breast Cancer Transparency.
	1.3. Summarizing and presenting the overview in the description of the analytical part of the dissertation.		

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Title of the work		Deadlines	Notes
2	Prosecution of scientific research	April 2025 - December 2025	
2.1	Formation of study methodology:		
2.1.1	The relevance of the topic is justified, the work problem is indicated and the goal is formulated.		The poster has been presented at a national conference highlighting the problem and presenting the proposed solution.
2.1.2	Tasks are selected and the problem to be solved is formulated.		The aim and objectives have been clarified. Start working on a methodology by using available datasets and apply different data augmentation techniques and using transformers to improve the diagnostic accuracy in breast cancer classification.
2.1.3	Presentation and description of the applied methodology or research method.		Findings in methodology will be presented at an international conference as an oral presentation or maybe a poster.

Description of scientific results obtained during the six-month period:

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- Literature review is conducted to find the limitations, gaps, emerging trends and tools in breast cancer detection using Explainable AI and Large language models for enhancing accuracy with interpretability.
- A literature review is mainly focused on Deep learning models with XAI and the role of Large Language Models (LLMs) in medical imaging and their potential to enhance breast cancer diagnostics.
- Reviewing the latest Breast Cancer screening approaches and identify some publicly available datasets for model development including (MIMIC Chest X-ray, CheXpert) and mammography datasets (MIAS, INbreast dataset, CBIS-DDSM,DMID) for breast cancer detection.

Work Plan for the next half year 2025/2026

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- The compulsory course: “Fundamental Methods of Informatics and Informatics Engineering Science” will be completed in the first quarter of 2026.
- To participate at an International conference and present research findings on Enhancing Breast Cancer Detection with Explainable AI and Large Language Model with Explainable AI.
- To prepare the draft of the research article.

Study Results

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The core contribution of the study are following:

- An analysis of the role of XAI, with a focus on healthcare domain particularly in breast cancer detection.
- Emerging trends and tools in XAI and LLMs for enhancing interpretability in AI.
- An exploration of how LLMs enhance the explanation by translating them into more understandable format.

Methodology

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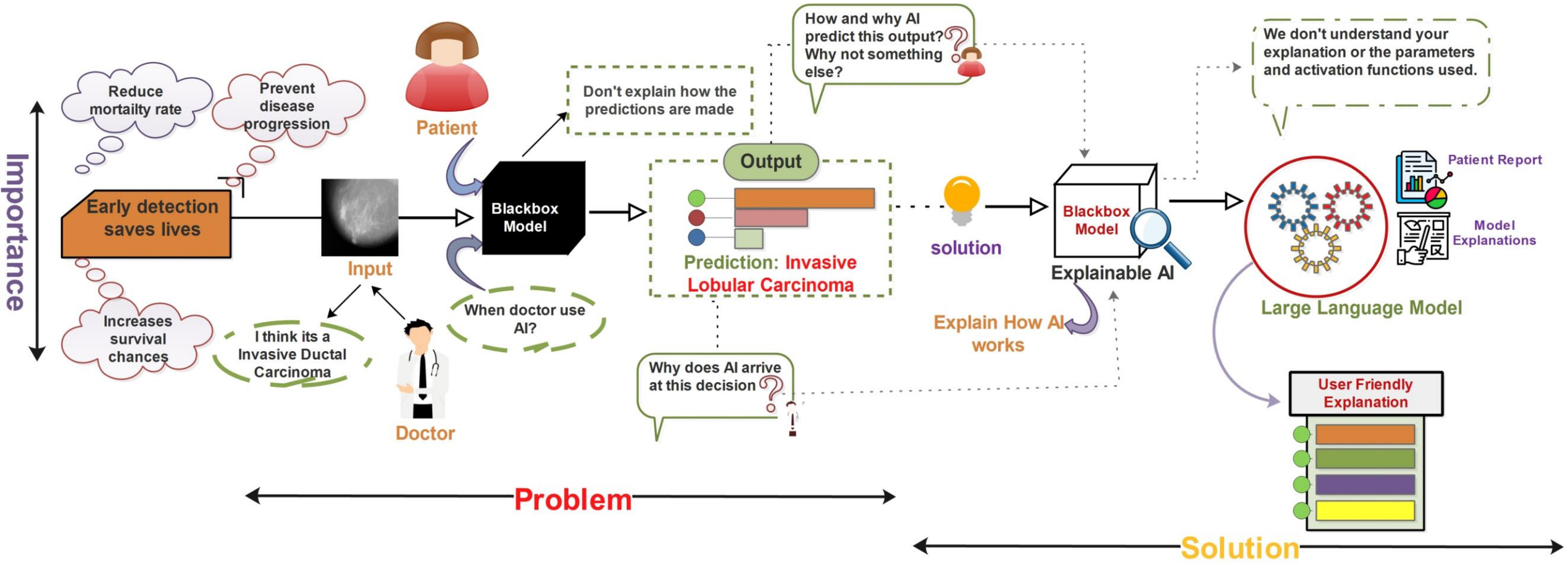

Taxonomy of AI Models and Explainability Approaches:

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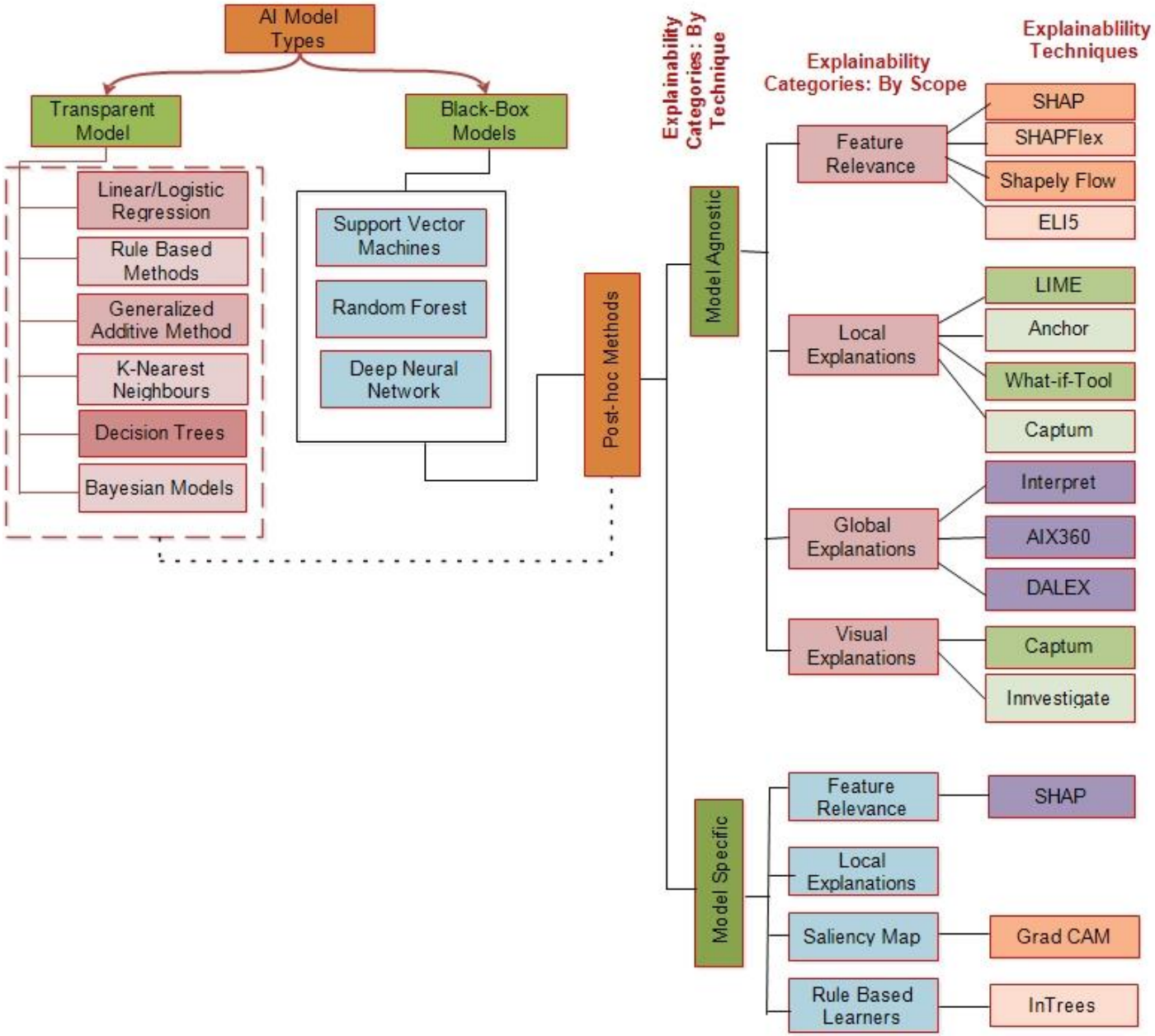

Conclusion

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In this study, we review the existing literature and provide a comprehensive analysis of Explainable AI (XAI), with a focus on its applications in healthcare and cancer diagnostics, while also highlighting the emerging role of Large Language Models (LLMs) enhancing AI interpretability and user centered explanations. This study explored the inherent interpretability challenges of Deep Learning models, clarifying why they are often described as ’black boxes. We discussed the limitations and challenges associated with current XAI methods, particularly in providing clear and meaningful explanations to end users. We highlight the critical need for trust between humans and AI, particularly in medical contexts, where even small errors in model predictions can have severe consequences. Futhermore, we explored the transformative potential of integrating LLMs into XAI systems, particularly in the context of AI-driven breast cancer diagnosis. In future work, we will address the need to integrate visual tools with textual explanations, enabling end users to better understand the critical regions of an image by visualizing them using techniques such as saliency maps or heatmaps, ultimately enhancing transparency and trust in AI systems.

Thank you.