Tentative Title:

Explainable Multimodal and Knowledge-Guided AI for Clinical Decision Support

1. Background and Motivation

My long-term research interest lies in artificial intelligence and machine learning, with a particular focus on computer vision, natural language processing, and explainable AI for healthcare applications.

During my participation in multiple international AI hackathons, I frequently worked on healthcare-related problem statements, which exposed me to real-world clinical challenges such as noisy data, limited annotations, and the critical need for model reliability. In the *Tech & Entrepreneurship Summit 4.0* healthcare AI hackathon, our team won first place. This work resulted in the development of an agentic healthcare intelligence platform (*MediVision AI*), which later informed and evolved into my final-year research project.

My final-year project, **VisionCare AI**, focuses on medical image analysis for disease detection and monitoring. Through this work, I realised that high predictive performance alone is insufficient in clinical settings. AI systems must also be interpretable, trustworthy, and aligned with clinical reasoning to be practically useful. This insight strongly motivates my interest in pursuing PhD research on explainable and multimodal AI for healthcare.

Selected project implementations related to this work are available on my GitHub for reference:

- **MediVision AI (Hackathon Project):** https://github.com/sajjadahmad-dev/MediVision-AI-Pakistan-First-Agentic-Healthcare-Intelligence-Platform
- **VisionCare AI (Final-Year Project):**

  https://github.com/sajjadahmad-dev/VisionCare-AI

2. Alignment with Dr Sun's Research

My proposed PhD research aligns very closely with Dr Sun's work, particularly in the following areas:

- Multimodal and explainable AI for healthcare
- LLMs integrated with structured knowledge and multi-agent decision support

Dr Sun's research on explainable multimodal AI for medical decision support, knowledge-guided reasoning, and multi-agent systems directly resonates with my goal of building clinically meaningful AI systems rather than black-box models. His work provides an ideal research environment for extending my existing experience into doctoral research.

3. Proposed Research Direction

At a high level, my PhD research aim is to:

Develop multimodal, explainable AI systems that integrate medical images, clinical text, and structured knowledge to support transparent and reliable clinical decision-making.

More concretely, I am interested in the following directions:

- **Multimodal & Explainable AI for Healthcare**

- ➢ Combining medical imaging with clinical text (reports, notes)
- ➢ Studying how multimodal fusion affects diagnostic accuracy and interpretability
- ➢ Developing explanation methods that align with clinical reasoning rather than relying solely on saliency maps

- **Knowledge-Guided and Agent-Based Clinical Decision Support**
  - ➢ Integrating knowledge graphs or symbolic medical knowledge with deep learning models
  - ➢ Using LLMs guided by structured knowledge for clinical reasoning and summarisation
  - ➢ Exploring multi-agent architectures where different agents handle perception, reasoning, and explanation

I see VisionCare AI and my hackathon project as starting points that show feasibility, while my PhD goal is to significantly deepen the theoretical, methodological, and explainability aspects under academic supervision.

4. Preparation and Potential Contribution

I believe I can contribute to this research through:

- ➢ Strong practical experience in AI/ML, deep learning, and computer vision
- ➢ Hands-on development of real-world healthcare AI systems
- ➢ Experience working in time-constrained, applied research environments (international hackathons)
- ➢ Strong motivation to strengthen theoretical foundations in machine learning, explainable AI, and agent-based systems during the PhD

My goal is to bridge practical AI system development with rigorous, explainable, and trustworthy methodologies, which I see as central to Dr Sun's research agenda.

5. Flexibility and Supervision

While I have a clear research direction, I remain flexible regarding specific problem formulations and would highly value shaping the research questions under Dr Sun's guidance, ensuring alignment with ongoing projects and funding opportunities.

6. Conclusion

Overall, my goal is not to pursue a PhD randomly, but to develop into a researcher working on trustworthy and explainable AI systems for high-stakes domains such as healthcare, under strong supervision and within a well-defined research programme.