CS6472 – Assignment 3: Notes & Critiques (Group 13)

Sai Keerthana (23192046)

Research question: Enhancing Brain Tumor Detection and Classification using Advanced Machine Learning Techniques

Notes from discussion (Siddharth Prince):

In terms of the outline for the literature review, there is clear planning of what needs to be researched prior to going ahead with the topic. The sub-topics are well rounded where it covers everything from research into the brain tumor itself to the current landscape in terms of machine learning models in use along with considerations on alternate input modalities that might give these models an edge.

However, the actual individual content for each subheading seems to be lacking substance in terms of specific advances/research or lack thereof which justifies the need for the proposed research question. For example, in the state-of-the-art section, there is a general mention of various approaches to solve the problem and a claim about there being room for improvement when it comes to accuracy. But there is no reference or any specific data to substantiate these claims. Also, the outline is missing the introduction part along with clear motivations for choosing this research question.

To be fair, the research matrix is more fleshed out in terms of the research questions, goals and the specific methods/instruments that will be employed for this research. The matrix is well done in my opinion.

Suggestions for improvement (Siddharth Prince):

- Providing references (even if just a couple to instill confidence in the reader) as to why the current state-of-the-art works or does not go a long way in substantiating claims made in the literature review.
- More specifics needed in terms of what kind of CNN model architectures instead of just generally saying CNNs would give a better idea of the current landscape in the field.

- More detail on what precisely the current challenges are in diagnosing brain cancer, both when done manually and when using existing digital pathology techniques will help underline the specific problem areas that need to be tackled.
- In general, it could do with more detail overall like in the research matrix.

Notes from discussion (Vikrant Shah):

The research outline is comprehensive and covers a critical aspect of medical imaging—brain tumor detection using advanced machine learning techniques. The literature review is thorough, demonstrating a good understanding of both the medical context and the technical challenges involved in brain tumor classification. The use of convolutional neural networks (CNNs) and other deep learning models is appropriately highlighted as cutting-edge and potentially transformative for the field.

Suggestions for improvement (Vikrant Shah):

- Given the challenge of limited images in open-source datasets, it's advisable to consider merging multiple datasets to increase the diversity and volume, ensuring the model is robust enough for accurate classification.
- To enhance the reliability of the results, it's recommended to incorporate rigorous validation methods, including cross-validation across different datasets, to test the model's performance in varied conditions.

Vikrant Shah (23158018)

Research question: How can we leverage Deep Learning for Enhanced Gleason Grading in Prostate Cancer Histopathology?

Notes from discussion (Sai Keerthana):

Your research problem is well defined and structured for a better understanding of your topic.

The literature review highlights an array of components like how deep learning in medical imaging has become pivotal, the relevance of the urinary bladder cancer diagnosis and various recent versions of deep learning for clinical findings particularly in prostate cancer. This identification lays a strong groundwork for the research.

The introduction explains the reason for study implying the criticality of improving diagnostic accuracy in prostate cancer using deep learning in facilitating patients with better outcomes.

Suggestions for improvement (Sai Keerthana):

You have mentioned acquiring prostate cancer histopathology images together with Gleason/ISUP scores. I think it may be useful to point out the sources of this data. Moreover, you can talk about the way you will develop a model to determine the efficiency of your model.

Notes from discussion (Siddharth Prince):

The research topic, goal and research question are well articulated and to the point. However, the research problem defined in the matrix are just statements given as facts. There is no problem defined with the way it is presented in the current form. In your case, it ideally should be a thesis statement detailing with what aspect of the Gleason grading system there is a problem for example that you aim to explore and potentially find a solution to. The research methods and instruments section of the matrix does not convey what tools you might use to tackle the research problem. Instead, it is a description of the general steps you would need to follow.

The literature review outline is detailed and has everything you would need to get a general outline of the project. However, there were no references to substantiate any of the claims made here. Though this is just the outline, a few references for crucial aspects of the outline, like the claim that current deep learning models match or potentially surpass pathologist-level grading for example, would go a long way. Other than this, it was well structured and put together.

Suggestions for improvement (Siddharth Prince):

- Properly define the problem statement for what you are trying to solve as in present the actual problem.

- Update the “research methods/instruments” part in the matrix to include detail on deep learning models or other tools that you would be leveraging for the project.
- Add references to the literature review outline especially for claims that seem to make or break the crux of your thesis statement.

Siddharth Prince (23052058)

Research question: How can we leverage Machine Learning for Automated HER2 Scoring in Breast Cancer Pathology?

Notes from discussion (Sai Keerthana):

You have Precisely identified the necessity of automated HER2 scoring in the pathology of breast cancer for enhanced accuracy and speed.

The research Problem and goals are defined well to understand the basics of the matrix

The dissertation outline acts as a roadmap for research by covering all the important aspects and a clear structure for the dissertation

Suggestions for improvement (Sai Keerthana):

You can provide the main outcomes of the research and their meaning for breast pathology, and in addition some drawbacks and suggestions for further research to enhance HER2 scoring accuracy and clinical usefulness.

Notes from discussion (Vikrant Shah):

The outline is well-structured and covers all necessary components of a comprehensive dissertation, from introduction to model evaluation. The research question is clear and highly relevant given the current challenges in breast cancer pathology. The motivation for the dissertation is compelling, especially the emphasis on the time-consuming nature of manual HER2 scoring and the potential for subjectivity in current methods.

Suggestions for improvement (Vikrant Shah):

- It was noted that the acquisition of data from hospitals often involves obtaining permissions which might be complex or time-consuming. It is suggested to have a contingency plan involving open-source datasets should there be any delays or issues with data access.
- Consider incorporating alternative machine learning models that have been specifically trained on medical data, including deep learning models trained on medical images. This could potentially improve the robustness and accuracy of your HER2 scoring.
- Since the dissertation deals with sensitive medical data, ensure that ethical implications are thoroughly discussed, especially concerning patient confidentiality and data handling.
- Ensure that the models are not only compared against manual scoring by pathologists but also validated through cross-validation techniques to assess their reliability and generalizability across different datasets.
- Engage with domain experts in pathology to gain insights that could refine the feature extraction process and improve the classification algorithms. This can also add credibility to the research.