Review of Project Proposal: Detection of Surgical Instruments Using YOLO: An Enhanced Approach

Summary (25%)

Major Claims of the Project: This proposal hopes to improve real-time detection of surgical instruments using advanced object detection. This approach, combined with transfer learning using the SOCAL dataset, should achieve better mean Average Precision (mAP) and improve detection efficiency. This improvement should be robust to data with occlusions and overlapping instruments present.

Relevance to CS-5814: This is aligned with CS-5814's focus because it applies deep learning principles to a real world problem within the field of medical computer vision. It showcases deep learning models, optimizations, and practical applications, which align with complex architectures discussed in this course.

Reflection (40%)

Comprehensiveness: The proposal covers the problem overview, related work, contributions, evaluation metrics, and planned experiments. The emphasis on transfer learning, details about the dataset, and real-time processing. It would be helpful to have more details on the intuition or expectation for the classification performance of the 2 models you will be comparing, specifically given the weaknesses of each model, what spectrum of Precision, Recall, F1, etc., scores in your results will confirm or contrast that intuition.

Uniqueness: As I review the references you gave, and did my own Google scholar search I'm seeing that this trade study is unique: YOLO and Faster R-CNN for detecting surgical instruments, great job selecting a problem that has little academic discovery applied to it

Guideline Adherence: For the most part this proposal follows the ACM format; however I notice on page 1; the ACM copyright footnote is present with information that not pertinent to this work; I suggest removing it or amending to reflect your stading in the community.

Technical Soundness: The use of transfer learning with SOCAL data and YOLO for real-time efficiency shows good technical grounding. I encourage you to do some research into what attributes of the models you are comparing lend each of themselves to drawbacks, so that this intuition can guide how you fine tune your model to your dataset.

Adequacy of Analysis: Metrics like mAP, precision, recall, and F1-score, are great for the analysis. I also suggest ROC plots.

Completeness: The proposal is complete, I suggest going deeper on the strengths and weaknesses of the models you are comparing to one another. Great job on all the references for your related work!

Pros/Cons (20%)

Strengths:

- **Relevance and Impact:** Deep learning within medical imaging for better surgical safety is relevant and a challenging problem - well done.
- **Detailed Plan:** Good job detailing the number of distinct labels within your training set.
- **Technical Depth:** The schematics and equations you have illustrate you know enough about the idea to carry it through, great job. Excellent job with your related work section, the cited references are very thorough.

Weaknesses:

- **Detailed Plan:** How will you split this data for train/test/validate?How long do you anticipate the training will take? If you don't have enough time will you decrement the training data? Use multiple hardware instances?
- **Challenge Discussion:** Include more detail around potential challenges, and suggest approaches to mitigate them.
- **Comparison with Non-YOLO Models:** YOLO and Faster R-CNN are the focus perhaps briefly mentioning other or newer detection models, like transformer based models could beneficial.

Presentation Quality (15%)

Quality: This proposal is easy to read and helped by the schematics and equations, perhaps add a larger scale image of a surgical instrument.

Clarity and Grammar: You have 2 periods at the end of the abstract - otherwise the grammar was excellent and clear.

Visuals and Formatting: Figures that show data and the model's architecture, is a excellent!. More visuals!

Overall Feedback

This is strong and fits with CS-5814's deep learning focus. It bridges deep learning with healthcare. To improve, discussing potential challenges in more detail and mention alternative emerging detection methods.