Project: Medical Robotics Proposal

ME 328: Medical Robotics

Stanford University ◆ Winter 2019

The purpose of this course component is for you to thoroughly plan a medical robotics research or development project that provides one or more new contributions to the field. This is achieved through the writing and presentation of the main components of a realistic grant proposal about the novel invention or modification of medical robotics technology. Developing a good proposal requires:

- A clear motivation for the proposed work
- A thorough understanding of the significance of the proposed work in the context of existing literature, products, and clinical practice
- Data/design/algorithms/simulation to support the feasibility of the proposed work
- A description of the proposed activities, including expected outcomes and alternative approaches
- A roadmap for how the work will lay the foundation for future research and development
- Clear and concise writing and figures with impeccable spelling and grammar

Your grant proposal will follow the guidelines of the National Institutes of Health Exploratory/ Developmental Research Grant Award (R21) funding mechanism. This grant mechanism is intended to encourage exploratory/developmental research by providing support for the early and conceptual stages of project development. A sample program announcement to which a medical robotics proposal might be submitted is provided at: https://grants.nih.gov/grants/guide/pa-files/PA-16-040.html. Sample R21 proposals from a different field are provided at: https://www.niaid.nih.gov/grants-contracts/sample-applications#r21. We will also provide sample medical robotics proposals *after* you develop your own ideas in the pre-proposal stage. (I don't want to bias your creative ideas!)

The project is to be completed in teams of **four students**, unless permission is given from the instructor to do otherwise. Team members will work together as a group to create a single submission for each required project component, so the same project grade is given to all members of the group. The remainder of this document describes each project component and gives the due date.

1. Pre-proposal (due Friday, February 15 at 4 pm)

Your pre-proposal consists of two pages:
- The first page includes:
  - the title of the project
  - the names of the team members
  - a list of three peer-reviewed papers relevant to your project
  - a short paragraph description of the supporting data you plan to collect (or design/algorithms/simulation you will create)
- The second page is a page of Specific Aims. This includes a description of the goals of the project, its importance, and a list of the specific aims to be undertaken. There is a 1-page limit. Required formatting for this and all other project documents is single column, single-spaced, 11-pt Arial font with 0.5-inch margins all around. The writing should be impeccable!

Get in touch with the instructor for guidance if you are having trouble finding a team or a proposal topic, or if you want guidance on what references are relevant to your project. After the instructor reads your pre-proposal, she will provide feedback and, if necessary, schedule a meeting to discuss it. Submit the pre-proposal document in PDF format to canvas via a group submission to the appropriate assignment.

2. Supporting data (due Friday, March 1 at 4 pm)

By now, you should have developed or acquired some data/design/algorithms/simulation to support your proposal. Submit a maximum 1-page description (including figures) of what you did and what the results were so far. Use the same formatting as for the Specific Aims. You can still do more work on this supporting data later if your initial results are not satisfactory. Submit the supporting data document in PDF format to canvas via a group submission to the appropriate assignment.

By this time, you should also have refined your 1-page Specific Aims document and drafted some of your 6-page-maximum Research Strategy document (in the same format). The Research Strategy is described below in the First Proposal Submission section.

3. First proposal submission (due Friday, March 8 at 4 pm)

Your proposal will include:
- A cover page with the proposal title and team member names
- A 1-page Specific Aims document
- A 6-page-maximum Research Strategy document, with the following sections:
    - (a) Significance (one page or less)
    - (b) Innovation (one page or less)
    - (c) Approach (the majority of the document)
- A list of references

A description of the components of the Research Strategy document is provided starting on page G-141 of the NIH SF424 Application Guide, provided at: https://grants.nih.gov/grants/how-to-apply-application-guide/forms-d/general-forms-d.pdf. Submit the first version of the proposal in PDF format to canvas via a group submission to the appropriate assignment.

4. Presentation (in class on March 11, 13, and 15)

Each team will present their proposal for 10 minutes. Structure your presentation to match the structure of the proposal. All team members should speak for a portion of the presentation. Each student will do an NIH score of all proposals based on the presentations, including those not assigned to that student for peer review (see below). These scores will be submitted in class.

5. Peer review (peer review due March 15 by 4 pm)

On the evening of March 8, each student (individually) will be assigned to review another team's proposal (using a provided template), following the NIH review criteria. These criteria will be discussed in class. The quality of the review will be part of your project grade. Complete your review based on reading the proposal and hearing the presentation. These reviews (included in a document called a "summary statement") will be provided to each proposal group to help them refine the final proposal. Submit your review in WORD format to canvas as an individual submission, with the file title "PeerReviewProposalX_Lastname". (Where "X" is the number of the proposal you reviewed and Lastname is your last name.) WORD is required so that I can combine reviews.

6. Final proposal submission (due March 20 by 4 pm)

The final proposal will contain the same elements as the first proposal submission (item 3 above). The proposal should be improved based on peer review results and feedback from the presentation. Submit the

final version of the proposal in PDF format to canvas via a group submission to the appropriate assignment.

Grading Scheme

Pre-proposal (10%): Have the team members delivered a well crafted and clearly explained proposal idea?

Supporting data (10%): Has the team provided sufficient demonstration of feasibility to support their proposed work? This grade will be based on the team's ability to meet the goals of the supporting data plan developed with the instructor after grading of the pre-proposal.

First proposal submission (required, but not scored): The instructor does not grade the first proposal submission, but this step must be completed. This version of the proposal will be used for peer review. The better the proposal is at this stage, the more likely the team will get useful feedback from the peer reviewers. In addition, the instructor will provide a summary of reviews and express any additional praise/concerns.

Peer review (10%): Each team member provides their own anonymous review of another team's proposal. The peer review will be graded on relevance and constructive suggestions for the proposal authors.

Proposal presentation (10%): The oral proposal presentation will be graded based on the team members' ability to clearly communicate the significance, innovation, supporting data, and approach of their proposal through prepared slides, verbal explanation, and answering questions. Note that lessons learned during the proposal presentation can be used to improve the final proposal.

Final proposal (60%):
Significance: 10% (part of standard NIH review criteria)
Innovation: 10% (part of standard NIH review criteria)
Supporting data: 20% (score can improve from first supporting data score, but cannot worsen)
Approach: 10% (part of standard NIH review criteria)
Writing/Presentation: 10% (are the writing and figures clear and correct?)

Details of standard NIH review criteria[1]:

Significance: Does the project address an important problem or a critical barrier to progress in the field? If the aims of the project are achieved, how will scientific knowledge, technical capability, and/or clinical practice be improved? How will successful completion of the aims change the concepts, methods, technologies, treatments, services, or preventative interventions that drive this field?

Innovation: Does the application challenge and seek to shift current research or clinical practice paradigms by utilizing novel theoretical concepts, approaches or methodologies, instrumentation, or interventions? Are the concepts, approaches or methodologies, instrumentation, or interventions novel to one field of research or novel in a broad sense? Is a refinement, improvement, or new application of theoretical concepts, approaches or methodologies, instrumentation, or interventions proposed?

Approach: Are the overall strategy, methodology, and analyses well reasoned and appropriate to accomplish the specific aims of the project? Are potential problems, alternative strategies, and benchmarks for success presented? If the project is in the early stages of development, will the strategy establish feasibility and will particularly risky aspects be managed?

Note: There is no background section in the proposal. Appropriate references (between 10 and 30 is suggested) should be cited as needed to demonstrate the significance or innovation of the work, and to support specific components of the approach.

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[1] Significance, Innovation, and Approach are three of the standard scored NIH review criteria. Other NIH criteria that we will *not* consider in this class are Investigators (i.e., do the investigators have the expertise to carry out the project) and Environment (i.e., how will the scientific environment in which the work will be done contribute to the success of the project, and what resources are available). I have added Supporting Data and Writing/Presentation, which should be graded explicitly for the purposes of this class.