BME 695M (Critical Literature Analysis) – Fall 2006
Computational Modeling of Hearing Impairment

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Time: W 11:40-1:20
Room: BMED 1001
Credits: 1

This course will focus on papers describing various types of modeling approaches to representing the physiological signal processing that occurs in the auditory system and how that changes with hearing impairment, as well as papers on how to apply these models to the design of better hearing-aid (and cochlear implant) signal processing strategies. Papers are posted on the WebCT site. The first week of class (August 30th) will be an overview of related topics by the instructor.

After the first class, please skim through the posted papers and email me your top 5 choices by midnight on August 30th. I will then email/post the schedule of presentations on Thursday August 31st and the student-led presentations will begin the following week (September 6th).

The remaining 7 weeks will be 1-2 student-led discussions of papers from the list below. Each student will be responsible for presenting one paper (i.e., leading a 45-minute detailed discussion and analysis of the paper, including motivation for the work, relevant background material, a critical analysis of the methods, results, and conclusions, and a discussion of the potential significance of this work – see Professor Rickus' Philosophy on Critical Literature Analysis). In addition to leading the discussion, each student will be responsible for writing a 1-page "summary statement" on the paper following the NIH guidelines for grant reviewers (see below). This summary statement will be due 1 week after your paper discussion. All students not presenting the paper will turn in an abstract for each paper discussed each week. These abstracts are to be written following the NIH guidelines for "Project Summary/Abstracts" (see below), which include sections on the project significance that are to be understandable by the general tax-paying public. Abstracts are to be limited to 250 words. All written assignments will be distributed to each member of the class.

Grading will be determined primarily based on your oral presentation and facilitation of an "active" discussion by your peers, as well as based on your summary statement, weekly abstracts, and participation throughout the course.

Grading:

Oral presentation/discussion facilitation	50%
Summary Statement	10%
Paper Abstracts	20%
Discussion Participation	20%

Written Assignments:
Abstracts: For each paper you are not presenting, submit a 250-word (total) abstract at the beginning of the discussion. The abstracts are to be written according to the NIH guidelines for grant submissions (from "PHS SF424 (R&R) Application Guide" – entire document posted on

WebCT). Add 1-2 sentences to the **Project Summary** section describing the results since the work has been completed, and stick to the 2-3 sentences limit for the **Relevance** section.

6. Project Summary/Abstract

The Project Summary must contain a summary of the proposed activity suitable for dissemination to the public. It should be a self-contained description of the project and should contain a statement of objectives and methods to be employed. It should be informative to other persons working in the same or related fields and insofar as possible understandable to a scientifically or technically literate lay reader. This Summary must not include any proprietary/confidential information.

*The first and major component of the Project Summary/Abstract (i. e., "Description") is a **Project Summary**. It is meant to serve as a succinct and accurate description of the proposed work when separated from the application. State the application's broad, long-term objectives and specific aims, making reference to the health relatedness of the project (i.e., relevance to the **mission of the agency**). Describe concisely the research design and methods for achieving the stated goals. This section should be informative to other persons working in the same or related fields and insofar as possible understandable to a scientifically or technically literate reader. Avoid describing past accomplishments and the use of the first person. Finally, please make every effort to be succinct.*

7. Project Narrative

For NIH and other PHS agencies applications, this attachment will reflect the second component of the Project Summary. *The second component of the Project Summary/Abstract (i.e., "Description") is **Relevance**. Using no more than two or three sentences, describe the relevance of this research to **public** health. In this section, be succinct and use plain language that can be understood by a general, lay audience.*

Summary Statement: For the paper you present, submit a 1-page summary statement 1 week following your paper discussion. The summary statement is to be written according to the NIH guidelines for grant submissions (from "PHS SF424 (R&R) Application Guide". Although these criteria don't fit perfectly for work that is already completed, it is useful to write your summary statement in these terms to start thinking about what is important (i.e., "fundable") research. Make sure to point out both the strengths and weaknesses in this work, e.g., as if this summary statement were to be used to determine funding.

Research Project Evaluation Criteria

Significance: *Does this study address an important problem? If the aims of the application are achieved, how will scientific knowledge or clinical practice be advanced? What will be the effect of these studies on the concepts, methods, technologies, treatments, services, or preventative interventions that drive this field?*

Approach: *Are the conceptual or clinical framework, design, methods, and analyses adequately developed, well-integrated, well-reasoned, and appropriate to the aims of the project? Does the applicant acknowledge potential problem areas and consider alternative tactics?*

In conducting an evaluation of the scientific assessment of Approach criterion, SRGs will also evaluate the involvement of human/animal subjects, the proposed plans for inclusion of minorities and members of both sexes/genders. The evaluation will be factored into the overall score for scientific and technical merit of the application.

Innovation: *Is the project original and innovative? For example: Does the project challenge existing paradigms or clinical practice; address an innovative hypothesis or critical barrier to progress in the field? Does the project develop or employ novel concepts, approaches or methodologies, tools, or technologies for this area?*

Investigator: *Are the investigators appropriately trained and well suited to carry out this work? Is the work proposed appropriate to the experience level of the PD/PI and other researchers? Does the investigative team bring complementary and integrated expertise to the project (if applicable)?*

Environment: *Does the scientific environment in which the work will be done contribute to the probability of success? Do the proposed studies benefit from unique features of the scientific environment, or subject populations, or employ useful collaborative arrangements? Is there evidence of institutional support?*

Articles

1. Beutelmann, R. and Brand, T. (2006) Prediction of speech intelligibility in spatial noise and reverberation for normal-hearing and hearing-impaired listeners. Journal of the Acoustical Society of America 120, 331-342.
2. Bruce, I.C., White, M.W., Irlicht, L.S., O'Leary, S.J. and Clark, G.M. (1999) The effects of stochastic neural activity in a model predicting intensity perception with cochlear implants: low-rate stimulation. IEEE Trans Biomed Eng 46, 1393-1404.
3. Bruce, I.C., Sachs, M.B. and Young, E.D. (2003) An auditory-periphery model of the effects of acoustic trauma on auditory nerve responses. J Acoust Soc Am 113, 369-388.
4. Carney, L.H. (1994) Spatiotemporal encoding of sound level: Models for normal encoding and recruitment of loudness. Hear Res 76, 31-44.
5. Chen, Z., Becker, S., Bondy, J., Bruce, I.C. and Haykin, S. (2005) A novel model-based hearing compensation design using a gradient-free optimization method. Neural Computation 17, 2648-2671.
6. Derleth, R.P., Dau, T. and Kollmeier, B. (2001) Modeling temporal and compressive properties of the normal and impaired auditory system. Hear Res 159, 132-149.
7. Huettel, L.G. and Collins, L.M. (2004) A theoretical analysis of normal- and impaired-hearing intensity discrimination. IEEE Transactions on Speech and Audio Processing 12, 323-333.
8. Kates, J.M. (1993) Toward a Theory of Optimal Hearing-Aid Processing. Journal of Rehabilitation Research and Development 30, 39-48.
9. Kates, J.M. (1995) On the Feasibility of Using Neural Nets to Derive Hearing-Aid Prescriptive Procedures. Journal of the Acoustical Society of America 98, 172-180.
10. Moore, B.C.J. and Glasberg, B.R. (2004) A revised model of loudness perception applied to cochlear hearing loss. Hear Res 188, 70-88.
11. Morse, R.P. and Evans, E.F. (1999) Additive noise can enhance temporal coding in a computational model of analogue cochlear implant stimulation. Hearing Research 133, 107-119.
12. Schaette, R. and Kempter, R. (2006) Development of tinnitus-related neuronal hyperactivity through homeostatic plasticity after hearing loss: a computational model. European Journal of Neuroscience 23, 3124-3138.
13. Siebert, W.M. (1970) Frequency Discrimination in the Auditory System: Place or Periodicity Mechanisms? Proceedings of the IEEE 58, 723-730.
14. Zhou, Y., Carney, L.H. and Colburn, H.S. (2005) A model for interaural time difference sensitivity in the medial superior olive: Interaction of excitatory and inhibitory synaptic inputs, channel dynamics, and cellular morphology. Journal of Neuroscience 25, 3046-3058.