Course Syllabus

CSD3317 Human Rhythms

Western University, September-December 2021

Instructor: David Purcell, Ph.D., Associate Professor
phone: 519 661-2111 x80435
email: purcelld@nca.uwo.ca

Teaching Assistant: (TBD but likely) Arman Hassanpour AsliShirJouPos <ahassanp@uwo.ca>

Office hour: Meetings welcome by appointment.
Lectures: 1:30-2:20pm Mondays and Wednesdays; Elborn College room 1548
Laboratory: 2:30-3:20pm; Session #1 Mondays, Session #2 Wednesdays; Elborn College room 1555
(Students need only attend one laboratory session; so that there is enough time for everyone with instructors in the lab, the class must split so we have near even numbers in each lab session)
Please note: It is possible that the COVID-19 response may change during our course, requiring us to be flexible.

1. Overview and Purpose of Course

The human body produces many rhythms from the brain (the electroencephalogram or EEG), heart (electrocardiogram or ECG), muscles (electromyogram or EMG), ears (otoacoustic emissions), and even the voice. These 'signals' can tell us about the body's function including clinically useful information used in the diagnosis of disease. Learning to work with physiological signals is a modern skill that is useful in diverse areas such as neuroscience, psychology, medical sciences, nursing, health and rehabilitation sciences, kinesiology, audiology, speech language pathology, and other sciences. In brief, this course introduces the basics of working with physiological signals measured from the human body.

You will learn how to view, process, and analyze example signals such as the heart's electrical activity, brain activity, and the human voice. Topics about signal processing will include introductions to how we represent signals, how to improve the quality of a measurement by filtering and removing artifacts, how to further remove noise with averaging (essentially improving the "signal-to-noise ratio"), as well as working with signals using both time and frequency representations. To obtain hands-on skills working with signals, students will learn some MathWorks MATLAB programing language to complete signal analysis exercises with instructors in the laboratory and subsequent related assignments.

Lectures will include a mix of familiar PowerPoint type slides as well as working through ideas using MATLAB. Material introduced in lecture is followed by weekly exercises in a laboratory session so that students can obtain direct experience with their new knowledge and develop programming skills with the help of instructors.

Course material will be delivered at a level appropriate for third year undergraduate students and I will not assume much mathematical knowledge or any programming experience. It is my purpose for the course that students without related backgrounds will learn the basics of signal processing and will take away basic programming skills that will be useful in other courses and future work. Knowing how to program can give an individual confidence and ability to take on interesting challenges in the future. Students with a background in these areas may find the course slower than their preference, but there may still be novel elements that are of interest.

2. Installing MATLAB

Western has a site license for MATLAB so you can choose to install it on your own computer! Read about that here: https://wts.uwo.ca/sitelicense/

And how to install on your machine:
https://wts.uwo.ca/sitelicense/matlab/index.html
Please note that you do not need to install all the available MATLAB "toolboxes". That would take a lot of your computer's storage space! We use the main program "MATLAB" plus the additional toolboxes called the "Signal Processing Toolbox" and the "Statistics and Machine Learning Toolbox". The Elborn College student computer room (EC1555) has computers with MATLAB available. We will use these during lab time and you can use them at other times too.

3. Course Textbook

a) There are two aspects to this course: signal processing and learning programming in MATLAB. I haven't been able to find a signal processing text that is at the right level or scope for the course. Therefore, I will provide what you need to learn about signal processing in lectures and some partial readings. The good news is that there are many appropriate texts that can help you to learn to program in MATLAB. There is no *required* text for the course, but you might find the text below helpful:

Mastering MATLAB by Duane Hanselman, Bruce Littlefield
2012 edition ISBN 9780136013303 (alk. paper); 0136013309 (alk. paper)

You can purchase a 180-day subscription to the ebook through the campus bookstore website. Alternatively, a physical copy can be ordered for delivery through the bookstore, or you can pick it up in store (some stock is available). The following link gives both the ebook and physical book as purchase options.

https://bookstore.uwo.ca/textbook-search?campus=UWO&term=W2021A&courses%5B0%5D=001_UW/CSD3317A

Unfortunately, this text is not an inexpensive reference book to own, but the subscription is a lower price.

An alternative text available from other vendors is less expensive, but it is less thorough and in some ways a more difficult read. It does however contain the basics if you don't worry so much about the exercises.

Getting Started with MATLAB: A Quick Introduction for Scientists and Engineers by Rudra Pratap
2016 edition ISBN: 0190602066, 978-0190602062

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Another alternative text is a little more advanced but would be an interesting reference for the future as well. Please note that one year the bookstore listed this as a required text by mistake. It is not required.

MATLAB for Brain and Cognitive Scientists by Mike X Cohen
2017 ISBN: 9780262035828

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Finally, the Taylor library has a nice introductory book with examples specific to sound and speech.

MATLAB primer for speech-language pathology and audiology by Boutsen, Dvorak
2016 edition ISBN: 9781597566537, 1597566535

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b) Additionally, there are many free online resources to help learn the programming language MATLAB.

One example is by the creators of MATLAB. You could look at “Get Started” and “Language Fundamentals” at the URL below:
https://www.mathworks.com/help/releases/R2020b/matlab/index.html

A second example is the MATLAB Onramp tutorials (the first of the "Course Offerings" at the URL given to the right). You will need to create an account: https://matlabacademy.mathworks.com/

There are also many videos for learning on YouTube. Here is an example set of learning videos that you might like:
https://www.youtube.com/watch?v=T_ekAD7U-wU

c) There is a free signal processing textbook available online, but it does not present material at the right level for our course:

http://www.dspguide.com/pdfbook.htm
The Scientist and Engineer's Guide to Digital Signal Processing by Steven W. Smith
1997 ISBN: 0-9660176-3-3

4. Evaluation

a) There will be four practical assignments over the course of the term that require use of your newly developed MATLAB programming skills to perform some signal processing and analyses. These assignments will follow classroom material that provides the necessary background information. You will need to write a “pseudocode” plan for your program in English and “comment” most lines of your MATLAB code using English descriptions so that it is straightforward for a reader to follow your approach. You may work collaboratively to learn the concepts, but the work you turn in must be your own.

Each assignment is worth 5% and the four together will compose 20% of your course grade. Late assignments will be accepted; however you will lose ½ point (i.e. 10% of the total mark) per day without a valid reason. The schedule for assignments will be posted the first week of classes.

b) Participation in labs is essential. Previous students have reported they are a very good learning experience. Concepts covered in the lectures will be reviewed and practical examples worked through. These examples will be relevant to the assignments, the project, and to the final examination. Participation in laboratory sessions is worth 5% of your course grade. Participation means attending and performing the planned exercises. The 5% will be evenly distributed over participation at the laboratory sessions. The lab schedule will be posted by the first week of classes. There is no lab that first week.

c) There will be a short “example test” during class time before the end of term. The purpose of this short test is to give you some experience of what the final examination will be like. Former students in this course suggested such a short test would be helpful in preparing them and reducing anxiety. This short test is worth 10% of your course grade. The date for the short test will be posted the first week of classes

d) There will be a project worth 25% of your course grade. That project will ask you to write MATLAB code that analyzes some human data and displays the results you calculate. To encourage you to think about the project and work on it prior to the deadline, you will be required to submit an English description of the major steps that you will undertake (worth 3% of the total 25%). The project format will be similar to what you have experienced in the assignments, but will require more thinking, planning, and coding.

The due date of the project will be at the end of term. The exact submission dates for the project and the English description will be posted the first week of classes.

e) There will be a final examination scheduled during the regular Western examination period from Friday December 10 to Tuesday December 21. Please do not make travel plans until the central scheduling people have provided us with an examination date and location. The final examination is comprehensive and may include material from any time during the course. That said, later course material is built upon earlier concepts, so those earlier concepts will have been reinforced as later material is learned. The examination will draw upon what you have learned in the classroom, laboratory exercises, and assignments. The final examination is worth 40% of your course grade.

5. More details about how the course will run

a) Questions?
Ask during class. Collaborate with your classmates. See me after class. Make an appointment to see me. Ask your teaching assistant. COVID-19 willing, I prefer to answer questions in person because I find it is less error prone to refer to figures and draw things out. If we need to transition to Zoom and screen sharing or another online format because of COVID-19, we will adapt. If you need to ask a straightforward question by email, I will respond during regular business hours. If you find yourself writing a long complicated email… just ask to meet me (live or Zoom) because that is what I will ask of you! If I think that your question may be relevant for others in the class, I will ask your permission to post an anonymized version and its response on OWL after our discussion. If you do e-mail, please use your Western email and use an informative subject line that begins with the course number (CSD3317). All faculty members receive a tremendous amount of email and it is too easy to miss messages that don't have clear subject lines.

b) Requests for formal academic accommodations must be made through Academic Support & Engagement (http://www.sdc.uwo.ca/ssd/).

c) Electronic devices: Notebook and tablet computer use in class and labs for note-taking and class-related activities is permitted but general web browsing and social media can be distracting to other students and are therefore not permitted. Smart-phone use and texting are not permitted. Non-programmable calculators are permitted in exams.

d) Classroom Atmosphere and Teaching Style:
I tend to ask a lot of questions in class, and, since we do not have a large group, I encourage you to do the same. I ask questions to facilitate the putting-together of concepts and information, to emphasize and reiterate important points, and to gauge whether explanations have been effective. I do not do it to put people "on the spot", so do not be afraid to give an "unexpected" answer – it may help the group to learn. If you dread after-question silences, speak up! It is my intention that our classroom be friendly and collaborative so that everyone has a good learning experience and there is no hesitation asking questions. My teaching approach emphasizes "learning by doing", which I feel has helped many of my students become comfortable with new ways of thinking and to excel at the "doing" part. You are expected to come prepared and to participate actively in the class and labs.

e) Health and Wellness
Students who are in emotional/mental distress should refer to the links at the bottom of this section for a complete list of options about how to obtain help. As part of a successful student experience at Western, we encourage students to make their health and wellness a priority. Western provides several on campus health-related services to help you achieve optimum health and engage in healthy living while pursuing your degree. For example, to support physical activity, all students, as part of their registration, receive membership in Western's Campus Recreation Centre. Numerous cultural events are offered throughout the

year. Please check out the Faculty of Music web page http://www.music.uwo.ca/ , and our own McIntosh Gallery http://www.mcintoshgallery.ca/ .

Students seeking help regarding mental health concerns are advised to speak to someone they feel comfortable confiding in, such as their faculty advisors, their program director, or other relevant administrators in their unit. Campus mental health resources may be found at
http://www.health.uwo.ca/mental_health/resources.html
https://www.uwo.ca/health/mental_wellbeing/
https://www.uwo.ca/health/

f) Academic Offenses
Students must do their own work. It is encouraged to learn together, but each individual must understand the material and work through problems themselves. If written answers use ideas, code, or short passages from other authors, they must be properly referenced. Plagiarism from fellow students or other sources is cheating and is a major offense.

Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following URL:
http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf

All code and text may be subject to submission for textual similarity review to the commercial plagiarism detection software under license to the University for the detection of plagiarism. All materials submitted for such checking will be included as source documents in the reference database for the purpose of detecting plagiarism of material subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between The University of Western Ontario and Turnitin
(https://elearningtoolkit.uwo.ca/tools/TurnItIn.html)

g) OWL: The class web page will be used to make lecture materials available. Assignments will be distributed and submitted through OWL, although we may also ask for a paper copy. Announcements will be made on OWL, and answers to questions of interest to the class will be posted.

h) Changes to the Timetable: There will be variations to the topic schedule (provided by the first week of class). My goal is that everyone learn the basics and we will cover what we can in the available time.

i) Accommodation for Illness and Following COVID-19 Protocols

Western recognizes that a student's ability to meet his/her academic responsibilities may be impaired by medical illness or the requirements of our COVID-19 response. Please refer to Western policies and supports for accommodation at these URLs:

https://www.uwo.ca/arts/counselling/procedures/medical_accommodation.html

https://www.uwo.ca/health/student_support/isolating-support.html

If the small test or final examination requires a makeup date, the makeup test/exam may or may not be the same format as the original.

j) Grading:

Please see the document AssignmentGradingScheme.pdf for detailed information about the manner used to grade assignments. It will be posted by the first week of classes. It may be different from what you have previously experienced. In brief, a set of "Descriptors" are defined and average student performance is given a grade of 4.0 out of five (80%). That is achieved by demonstrating good performance on most or all

of the descriptors. A higher grade requires going above and beyond good performance on most or all of the descriptors. For example, think of what might be an interesting data metric to calculate and report or an interesting way to display the data that wasn't asked for in the assignment. Please read the grading document so you are familiar with the approach.

After an assignment or test is returned, students should wait 24 hours to digest feedback before contacting their evaluator; to ensure a timely response, please reach out within 7 days. Please contact your teaching assistant or myself within two weeks of the return of your work if you wish to appeal your grade.

We strive to maintain high standards that reflect the effort that both students and faculty put into the teaching and learning experience during this course. All students will be treated equally and evaluated based only on their actual achievement. Final grades on this course, irrespective of the number of decimal places used in marking individual assignments and tests, will be calculated to one decimal place and rounded to the nearest integer, e.g., 74.4 becomes 74, and 74.5 becomes 75. Marks will not be bumped to the next grade or GPA, e.g. a 79 will not be bumped up to an 80, an 84 will not be bumped up to an 85, etc. The mark attained is the mark you achieved, and the mark assigned; requests for mark "bumping" will be denied.

k) The expected schedule for classes and labs, and their expected topics, will be posted by the first week of class.

Thanks for your interest in CSD3317!
It is my plan that everyone takes away some new knowledge and useful skills!