QUEEN'S UNIVERSITY
ELEC 823 Signal Processing (Winter'23)

Instructor: Geoffrey Chan, chan@queensu.ca.

Lecture: Wed 2:00-3:20 p.m. & Fri 1:00-2:20 p.m. in WLH 620.

Prerequisites: Probability and Random Processes (comparable to ELEC 326 or ELEC 861) and Digital Signal Processing (comparable to ELEC 421)

Grading: Homework (40%), project (50% report + 10% presentation).

Course Outline: This course covers selected topics in statistical signal processing and machine learning. The methods studied enable numerous applications that need analysis, enhancement, and understanding of information bearing signals and data, such as speech, communications, biomedical/health, etc. The lectures are divided into two parts, with the first covering spectral modeling and adaptive filtering, setting the stage to study machine learning next.

At its core, DSP is about designing algorithms which are amenable to software and/or hardware processing of the target signals/data. The course project enables you to practice algorithm design. The project work has three components: computer simulation (using any suitable language), oral presentation, and a written report. Students have wide latitude in fashioning their own projects. For this, a guide will be distributed before mid-term.

Lecture Topics (may be adjusted)	**Weeks**
Random processes & spectral modeling; linear prediction	2
Wiener & LMS adaptive filters	2
Bayesian inference & decision theory	2
Linear models & discriminants	2
Regression & logistic regession	2
Hidden Markov models	2

References

1. Proakis & Manolakis, "Digital Signal Processing," 4th ed., Prentice Hall, 2007.
2. Haykin, "Adaptive Filter Theory," 4th ed., Prentice Hall, 2002.
3. Bishop, "Pattern Recognition and Machine Learning," Springer, 2006.
4. Goodfellow, Bengio, & Courville, "Deep Learning," MIT Press, 2016.
5. Hastie, Tibshirani, & Friedman, "The Elements of Statistical Learning," 2nd ed., 2009. [FREE]
6. Rasmussen & Williams, "Gaussian Processes for Machine Larning," 2006. [FREE]
7. Duda, Hart, & Stork, "Pattern Classification," 2nd ed., Wiley, 2001.
8. Huang, Acero, & Hon, "Spoken Language Processing," Prentice Hall, 2001.
9. Rabiner & Juang, "Fundamentals of Speech Recognition," Prentice Hall, 1993.
10. Gray & Davisson, "An Introduction to Statistical Signal Processing," 2004. [FREE]
11. Stark & Woods, "Probability and Random Processes with Applications to Signal Processing," 3rd ed., Prentice Hall, 2001.