CPSC 644-600 Cortical Networks: Spring 2010

Syllabus

NEWS: *1/18/10, 04:38PM (Mon)*

- [1/18] Course web page goes online
- ----------
- Links: Lectures, Documents, News archive

Read-Only Bulletin Board.: 1/18/10, 04:11PM (Mon)

Page last modified: 1/18/10, 04:46PM Monday.

General Information | Resources | Reading List | Weekly Schedule | Lecture Notes | Course Material

I. General Information

Instructor:

Dr. Yoonsuck Choe
Email: choe(a)tamu.edu
Office: HRBB 322B (or HRBB 507, if I'm not in 322B)
Phone: 845-5466
Office hours: 4pm-5pm, TR

TA: N/A

Prerequisite/Restrictions:

CPSC 420, 625, 636, or 633 (or equivalent) and graduate classification; or consent of instructor.

Lectures:

TR 5:30–6:45pm HRBB 104.

Introduction:

From the course catalog: *The architecture of the mammalian cerebral cortex; its modular organization and its network for distributed and parallel processing; cortical networks in perception and memory; neuronal microstructure and dynamical simulation of cortical networks; the cortical network as a proven paradigm for the design of cognitive machines.*

About this semester: This course will provide necessary background for modeling the structure (anatomy), function (physiology), and growth (development) of neurons, neuronal circuits, and neuronal networks. Various computational concepts, techniques, and tools necessary for modeling neural systems will be introduced. A selected set of latest papers in the field of computational neuroscience and neuroinformatics will be surveyed.

Textbook:

- **Required**
  1. Peter Dayan and L. F. Abbott, *Theoretical Neuroscience*, MIT Press, 2001.
- **Recommended**
  1. Risto Miikkulainen, James A. Bednar, Yoonsuck Choe, and Joseph Sirosh, *Computational Maps in the Visual Cortex*, Springer, 2005. [Book web page with all figures]
  2. Thomas Trappenberg, *Fundamentals of Computational Neuroscienec*, 2nd edition, Oxford University Press, 2010.
  3. Gordon M. Shepherd (Editor), *The Synaptic Organization of the Brain*, Oxford UP, 2004.
  4. Fred Rieke and David Warland and Rob de Ruter van Steveninck and William Bialek, *Spikes: Exploring the Neural Code*, MIT Press, 1997.
  5. Wulfram Gerstner and Werner M. Kistler, *Spiking Neuron Models: Single Neurons, Populations, Plasticity*, Cambridge UP, 2002. [Full book online]
  6. James M. Bower and David Beeman, *The Book of GENESIS*, Telos, 1998. [Full book online]
  7. Erik De Schutter (Editor), *Computational Neuroscience: Realistic Modeling for Experimentalists*, CRC Press, 2001.
  8. Christof Koch and Idan Segev, *Methods in Neuronal Modeling*, MIT Press, 1998.
  9. Michael A. Arbib (Editor), *The Handbook of Brain Theory and Neural Networks*, MIT Press, 2003.
  10. Leo Van Hemmen and Terrence Sejnowski (Editors), *23 Problems in Systems Neuroscience*, Oxford UP, 2006.
  11. Purves et al., *Neuroscience*, Sunderland, MA: Sinauer, 1997.

Administrative Trivia:

1. Computer accounts: if you do not have a unix account, ask for one on the CS web page.
2. Programming languages permitted: C/C++, Java, or Matlab (or octave), and must be executable on CS unix hosts or any windows system in the departmental lab.

Topics to be covered:

See the Weekly Schedule section for more details.

Grading:

1. Quiz (one or two): 10%
2. Paper commentaries (3 to 4, each one paragraph long): 20%
3. Programming assignments/exercises (about 3): 10% each = 30%
4. Term project: proposal, presentation, final report 40%

Grading will be on the absolute scale. The cutoff for an `A' will be at most 90% of total score, 80% for a `B', 70% for a `C', and 60% for a `D'. However, these cutoffs might be lowered at the end of the semester to accomodate the actual distribution of grades.

Academic Integrity Statement:

AGGIE HONOR CODE: An Aggie does not lie, cheat, or steal or tolerate those who do.

Upon accepting admission to Texas A&M University, a student immediately assumes a commitment to uphold the Honor Code, to accept responsibility for learning, and to follow the philosophy and rules of the Honor System. Students will be required to state their commitment on examinations, research papers, and other academic work. Ignorance of the rules does not exclude any member of the TAMU community from the requirements or the processes of the Honor System.

For additional information please visit: http://www.tamu.edu/aggiehonor/

Local Course Policy:

- Collaboration is allowed, but final submitted material should be in your own words.

Americans with Disabilities Act notice:

The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact the Department of Student Life, Services for Students with Disabilities, in Cain Hall or call 845-1637.

Resources:

1. Research resources page
2. Ganeral reading list (u: p:): includes short blurb about how to find, read, and critique others' work.

This list is **not** the course reading list.

III. Weekly Schedule and Class Notes

- **Lecture notes (in PDF format)**: all notes will be uploaded in this directory.
- It is **your responsibility** to download, print, and bring the notes to the class. Notes will be available 24 hours before each class.
- See the **2010 TAMU Calendar (click on Spring 2010)** for breaks, etc.

Week	Date	Topic	Reading	Assignments	Notices and Dues	Notes
1	1/19	Introduction	Course overview, Terminology			slide01.pdf slide02.pdf
1	1/21	Introduction, Neuron	Terminology, Shepherd: Chapter 2			slide02.pdf slide03.pdf
2	1/26	Neuron: Computational models	Dayan and Abbott: Chapter 5, Appendix A.4			slide04.pdf
2	1/28	Neuron: Computational models	Dayan and Abbott: Chapter 5, Appendix A.4			slide05.pdf
3	2/2	Thalamus	Shepherd: Chapter 8			slide06.pdf slide07.pdf
3	2/4	Thalamus Model	Choe (2004) [PDF]			slide08.pdf
4	2/9	Neuron: Plasticity	Dayan and Abbott: Chapter 8			slide09.pdf
4	2/11	Neuron: Plasticity; Neural encoding	Dayan and Abbott: Chapter 8; Dayan and Abbott: Chapter 1			slide09.pdf slide10.pdf
5	2/16	Neural Encoding; Visual System: Computation	Dayan and Abbott: Chapter 1; Miikkulainen et al. (2005) Chapters 1,2,3			slide10.pdf slide11.pdf
5	2/18	Visual System: Development	Miikkulainen et al. [eBook]: Chapter 4, 5			slide11.pdf
6	2/23	Visual System: Development; Delay compensation	Miikkulainen et al.: Chapters 4 and 5; Lim and Choe (2006) [PDF]			slide11.pdf slide12.pdf

6	2/25	Delay Compensation; Neocortex	Lim and Choe (2006) [PDF]; Shepherd: Chapter 12; Douglas and Martin (2004) [PDF]	slide12.pdf slide13.pdf
7	3/2	Basal Ganglia; Motor System	Shepherd: Chapter 9; Choe and Smith (2006) [PDF]	slide14.pdf slide15.pdf
7	3/4	Motor System: Decoding Internal State	Choe and Smith (2006) [PDF]	slide15.pdf
8	3/9	Computational Tools Showcase; Term project discussion; Motor System: RF Development	Topographica, xppaut, octave, SIDA, neuroevolution;Reto Wyss et al. (2006) [PDF]	slide16.pdf slide17.pdf
8	3/11	Motor System: RF Development; Motor System: Response Tuning	Reto Wyss et al. (2006) [PDF]; Emilio Salinas (2006) [PDF]	slide17.pdf slide18.pdf
9	3/16	**Spring break**		
9	3/18	**Spring break**		
10	3/23	Motor System: RF Development	Floreano et al. (2005) [PDF]	slide19.pdf slide20.pdf
10	3/25	Natural Images: Response Statistics and Salience, Statistical Structure	Choe and Sarma (2006) [PDF]; Xiuwen Liu and DeLiang Wang (2002) [PDF]	slide20.pdf slide21.pdf
11	3/30	**Guest lecture**		
11	4/1	**Guest lecture**		
12	4/6	Neuron Morphology	De Schutter: Chapter 6 and 7	slide22.pdf
12	4/8	Neuron Morphology: Statistical Description	Ascoli et al. (2001) [PDF]	slide23.pdf
13	4/13	Network Analysis: Complexity	Sporns and Tononi (2002) [PDF]; Sporns et al. (2004) [PDF]	slide24.pdf
13	4/15	Network Analysis: Shortest Path; Network	Kaiser and Hilgetag (2006) [PDF]; Thiel et al. (2003)	slide25.pdf slide26.pdf

		Dynamics	[PDF]	
14	4/20	Systems Neuroscience	Van Hemmen and Sejnowski: Chapters 1, 13, and 19	slide27.pdf
14	4/22	Dynamics	Heinz Von Foerster	slide28.pdf
15	4/27	Project Presentation		
15	4/29	Project Presentation		

$Id: index.php,v 1.4.1.7 2003/11/13 00:02:12 choe Exp choe $