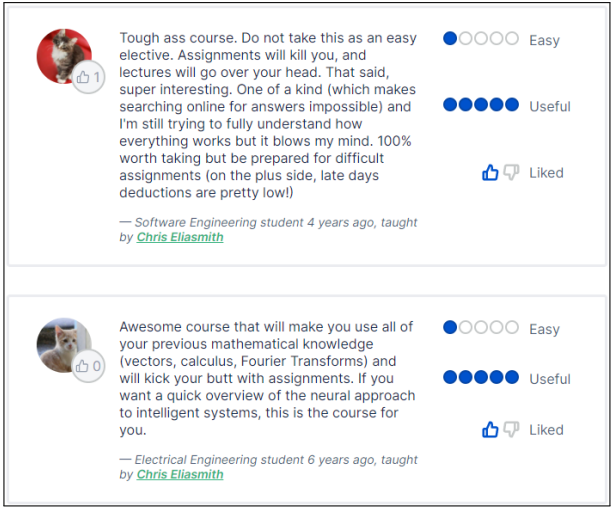
SYDE 556/750
Simulating Neurobiological Systems
Lecture 0: Administrative Remarks

Terry Stewart

September 8, 2021

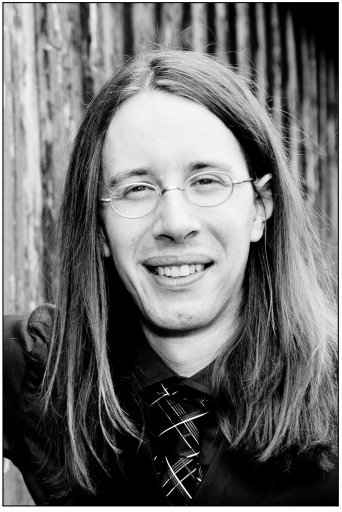
UNIVERSITY OF WATERLOO | FACULTY OF ENGINEERING

Warning



- The UWFlow reviews are accurate.
- This is a tough course.
- Be prepared to spend a lot of time on the assignments.
- We'll be making use of pretty much everything in the SyDe undergrad program, and applying it to cognitive science and neuroscience.
- Unique course on an approach developed here at Waterloo by a SyDe graduate.

About Me



- Terry Stewart
- Research Officer at the National Research Council Canada (NRC)
  - Investigate algorithms underlying biological cognition
  - Build computational models of them
  - Determine if they may be useful to industry
- Undergrad: Systems Design Engineering at Waterloo
- Masters: M.Phil in Comp.Sci and AI at Sussex University (UK)
- PhD: Cognitive Science at Carleton University (Ottawa)
- Post-doc: at Waterloo, working with Chris Eliasmith on the research discussed in this course.

Organization (I)

Instructor

Terry Stewart

Email terry.stewart@gmail.com
Website https://terrystewart.ca

Course website

- LEARN
- https://github.com/tcstewar/syde556-f21
- syde556-f21.slack.com

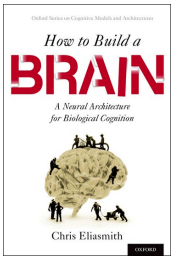
Organization (II)

Course times and logistics

- **Saturday:**
  Pre-recorded lectures posted
- **Monday:**
  8:30-9:50 online lecture and discussion (LEARN)
- **Tuesday:**
  9:00-9:50 online discussion (LEARN) (SYDE 750, optional for 556)
- **Wednesday:**
  8:30-9:50 online lecture and discussion (LEARN)
- **Any time:**
  Email `terry.stewart@gmail.com`
  Slack `syde556750-f21.slack.com`

Textbooks and Readings

Main text:
Chris Eliasmith and Charles H. Anderson *Neural Engineering: Computation, Representation, and Dynamics in Neurobiological Systems*, MIT Press, 2003.



Optional:
Chris Eliasmith *How to Build a Brain*, Oxford University Press, 2013.

Coursework (SYDE 556 & SYDE 750)

Five Assignments

- 20%, 20%, 15%, 15%, 30%, respectively
- Roughly two weeks for each assignment
- Everyone must write their own code, generate their own graphs, and write their own answers.

Final Project (SYDE 750 only)

- Build a model of some neural system.
- Replicable science: report everything needed to recreate your model and analysis
- 20% of grade (assignments are rescaled to 80%)
- Have your project proposal approved via email by Oct 27

Coursework (SYDE 750 only)

Class Participation in the Seminar (SYDE 750 only; optional for SYDE 556)

- General discussion about Neuroscience, cognitive science, AI, etc.
- Special interest: replicable science and computational modelling
- SYDE 750 students must attend the seminar (Tuesday, 9:00-9:50).
- No marks for this part of the course.

Schedule (I)

Date	Reading	Topic	Assignments
WEEK 1			
Sept 8	Chapter 1	Introduction	
WEEK 2			
Sept 13	Chapter 2	Neurons	
Sept 15	Chapter 2	Population Representation (I)	#1 posted
WEEK 3			
Sept 20	Chapter 2	Population Representation (II)	
Sept 22	Chapter 4	Temporal Representation	
WEEK 4			
Sept 27		Guest Lecture	
Sept 29		Guest Lecture	
WEEK 5			
Oct 4	Chapters 5, 6	Feedforward Transformations (I)	#1 due*, #2 posted
Oct 6	Chapters 5, 6	Feedforward Transformations (II)	
WEEK 6		*— Reading week, no lectures —*	

Schedule (II)

Date	Reading	Topic	Assignments
WEEK 7			
Oct 18	Chapter 8	Dynamics (I)	
Oct 20	Chapter 8	Dynamics (II)	
WEEK 8			
Oct 25	Chapter 7	Analysis of Representation	#2 due*, #3 posted
Oct 27	*provided*	Temporal Basis Functions	SYDE 750 Project proposal due
WEEK 9			
Nov 1	*provided*	Symbols (I)	
Nov 3	*provided*	Symbols (II)	
WEEK 10			
Nov 8	Chapter 8	Memory	#3 due*, #4 posted
Nov 10	*provided*	Action Selection	

Schedule (III)

Date	Reading	Topic	Assignments
WEEK 11			
Nov 15	Chaper 9	Learning (I)	
Nov 17	Chaper 9	Learning (II)	
WEEK 12			
Nov 22	*provided*	Spatial Semantic Pointers	#4 due*
Nov 24	*provided*	Biological Details	
WEEK 13			
Nov 29	*provided*	Other modelling frameworks	
Dec 1		Conclusion	
WEEK 14			
Dec 6		Discussion	
WEEK 16			
Dec 23			#5 due; SYDE 750 projects due*

* The project and all assignments are due at midnight ($\approx$ 11:59p Eastern) of that day.

Homework

- **Get the textbook, read the first chapter**
  ("Neural Engineering", Chris Eliasmith and Charles Anderson, 2003)

- **Be able to run `jupyter lab` or (`jupyter notebook`) with Python 3**
  Install `numpy`, `scipy`, and `matplotlib`. You may want to use Anaconda, which ships with these packets preinstalled.