krai.com

Learning to Crawl

- Early: reinforcement-driven learning
- Late: add error-driven learning

tesco-baby.com

- Many typically developing babies are crawling by 7-8 months of age

Learning to Crawl

Crawling drives the learning of spatial skills

- Constructing maps of their environments
- Reasoning about these maps, including planning

howwemontessori.com

Cerebral Palsy

- Often due to physical damage that occurs at or around the time of birth
- Affects 3 in 1000 babies
- In part, affects the flow of information from the brain to the musculature
  - Reduction in motor strength and coordination

Cerebral Palsy

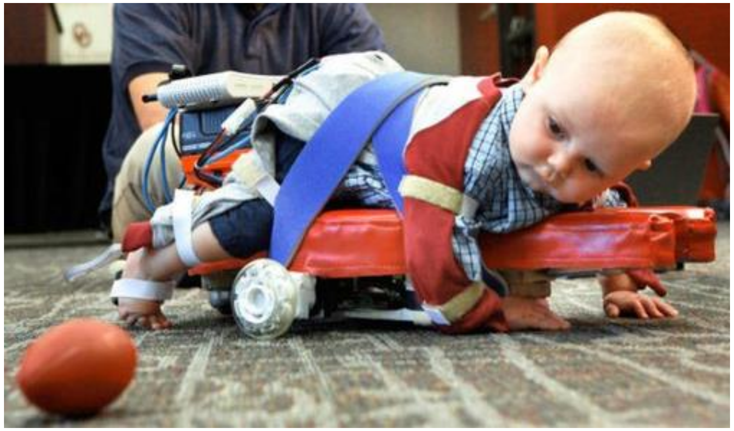
- Limits in movement generation can lead to substantial delays in learning to crawl
  - On average, children with Cerebral Palsy learn to crawl at ~24 months
- Miss key opportunities to learn spatial skills

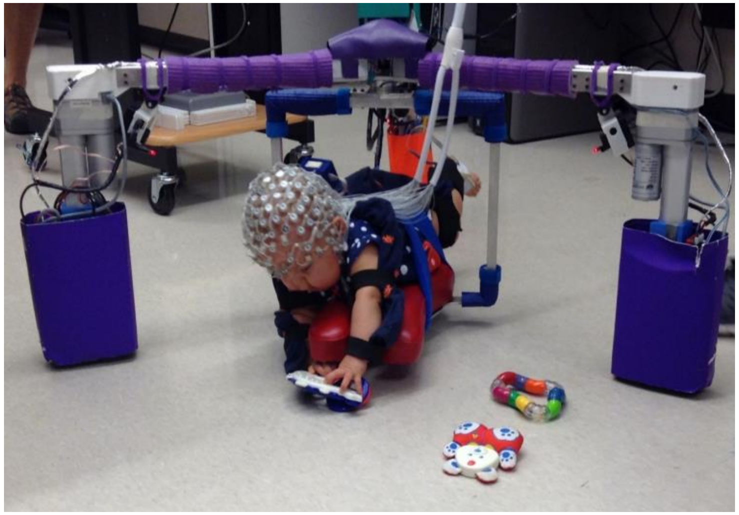
Self-Initiated Prone Progression Crawler (SIPPC)

Robot assistant that supports the weight of the infant and amplifies crawling effort

- Encourage crawling practice
- Enable exploration of the environment

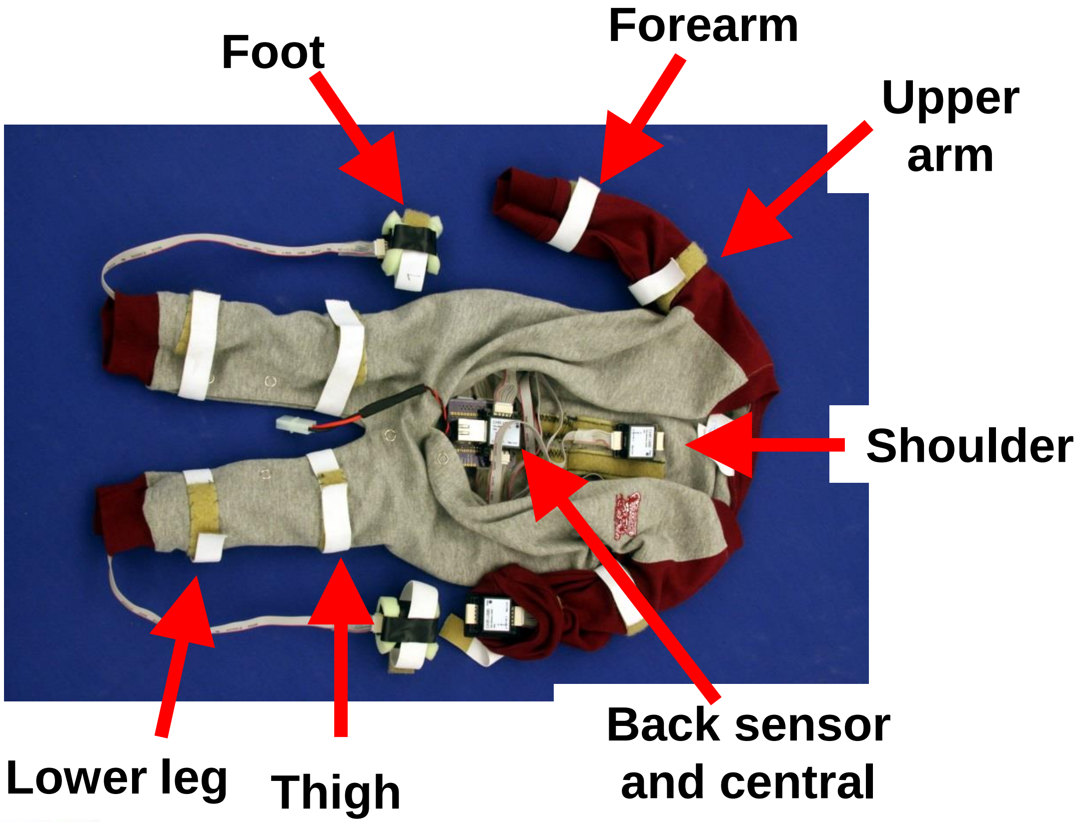
Kolobe, Fagg, Miller, Ding





Data Collection

- Kinematic: position & velocity from 11 points on the body
- Robot: movement in response to infant
- EEG: brain activity
- Video: behavior



~ 8 TB of data in the last 5 years

Southerland (2012)

Experimental Questions

- How does infant movement change with development?
- How does the infant brain change relative to key developmental milestones?
- How does the robot affect learning?
- What is the best way for the robot to interact with the infant to facilitate learning?

Computer Science Components

- Sensing and control
- Real-time data collection
- Multi-modal data analysis on multiple time scales
- Brain modeling

As computer scientists, we interact on a daily basis with several different disciplines

What do you want to do with your CS (or related) degree?

CS 2334:
Programming Structures and Abstractions (aka Java 2)

Dr. Andrew H. Fagg

Department of Computer Science

Symbiotic Computing Laboratory

Teaching Assistants:

Monique Shotande, Manvir Kaur, Stephen Thung,Vishnu Medisetty, Sravani Veluru

This software stuff is hard … Why?

This software stuff is hard … Why?

Complexity due to:

- Different types of data
- Users are diverse!
- Different use cases
- Different needs
- Code base gets large
- Multiple programmers
- Coordinating many activities at once

http://www.extremetech.com/extreme/118863-nevada-embraces-the-future-approves-self-driving-cars

Why Should We Care?

and does it matter that we get it right?

Why Should We Care?

Does it matter that we get it right?

- Correct and efficient implementation is important to our customers & employers
- Resources are often precious: e.g., data, people, and CPU
- Lives can be at stake (literally)
- We can change the world

Helping children at risk for Cerebral Palsy learn how to crawl

Photo credit: Hugh Scott

This software stuff is hard …

How do we get a handle on the challenges?

Abstraction

Abstraction

- Abstraction: the process of simplifying the representation or description of some entity
  - Keep the key pieces
  - Hide the extraneous details
- In software development: we use abstraction to temporarily hide details so that we can get our mind around the big picture

Abstraction

Not just one level of abstraction possible: we can imagine multiple levels of abstraction, depending on what we are working on and what we need to communicate

Course Coverage

- Abstraction and Object Oriented Programming
- Software development
  - Design
  - Implementation
  - Testing
  - Debugging
- Ethics in computer science

Design

Design: the process of assessing the requirements of a software system and planning a solution

- What are the inputs and outputs?
- What happens in between and how?
- How do we know when our implementation is correct?

Abstraction is key for many of these steps

Implementation

- Connecting our design and our solution
- Maintaining a separation of the logic of our solution from the implementation
- Tools that help us to manage our abstractions

Testing and Debugging

- Testing procedures are designed (often ahead of time)
- Testing procedures for different pieces of the code base
- Tools that allow us to analyze what our code is doing and what it is "thinking"
- Isolation of "buggy" code

Ethics in Computer Science

Processes for detecting and analyzing ethical questions that can arise in the computing solutions that we develop

- Privacy
- Intellectual property

My Assumptions About You

- At least one introductory course in programming
- Experience with java, including:
  - Control structures: if-then-else, while, for, switch
  - Basic data types: integers, floats, chars, strings
  - Exposure to java objects
- Experience with writing and debugging your own programs

ABET outcomes

- B: An ability to analyze a problem, and identify and define the computing requirements appropriate to its solution
- C: An ability to design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs
- K: An ability to apply design and development principles in the construction of software systems of varying complexity
- E: An understanding of professional, ethical, legal, security, and social issues and responsibilities.

Course Details

Grading

- 5 Projects: 25%
- 15 Labs: 15% (keep 14 highest; must keep labs 14 & 15)
- Exams: 40% (two midterms and a final)
- Homework: 10% (exercises in the Zyante readings; keep N-1 highest)
- In-class exercises: 10% (Top Hat; keep M-1 highest)

Official grades will be posted in Canvas

Laboratory Assignments

- Attend the lab session in which you have enrolled
- Lab sessions are 110 minutes long
  - Short lecture and introduction to the lab assignment
  - Time to work on the lab itself and get help from the teaching assistants
- Labs 1-13 are due on Saturday
- Labs 14-15 are due at the end of the session

Projects

- 5 two-week long projects over the semester
- You will need this time
- Projects are done in assigned pairs

- Grading:
  - Sign up for a code review time slot
  - Both group members must be present at the review
  - Both must be ready to answer any questions about the code

Proper Academic Conduct

Laboratory assignments, homework assignments, in-class exercises and exams:

- All work must be your own: no looking at or copying solutions from other students or from the net
- General discussion is OK (e.g., the fundamental skills that we are learning)
- When in doubt: ask me or a TA

Proper Academic Conduct

Projects:

- All work must be that of your group: no looking at, discussing or copying solutions from other groups or from the net
- General discussion across groups is OK
- Group members must contribute equally to each project

Proper Academic Conduct

- Sharing solutions is punished to the same degree as receiving solutions
- Make sure that your computer and account are properly protected. Use a good password
- Do not give out access to your account or your computer system
- Do not leave printouts or mobile drives around a laboratory where others might access them

Proper Academic Conduct

Programming projects will be checked by software designed to detect collaboration. This software is extremely effective and has withstood repeated reviews by the campus judicial processes.

Conduct Violations

- Upon the first documented occurrence of inappropriate collaboration, I will report the academic misconduct to the Campus Judicial Coordinator. The procedure to be followed is documented in the University of Oklahoma Academic Integrity Code
  - http://integrity.ou.edu/files/Academic_Misconduct_Code.pdf
- The appeals process for both admonitions and full complaints is described at:
  - http://integrity.ou.edu/

Course Information

- Instructor: Dr. Andrew H. Fagg
- Class Location: Dale Hall 128
- Required Resources:
  - Programming in Java (Zyante)
  - The **Fourth** Edition of *A Gift of Fire: Social, Legal, and Ethical Issues for Computing and the Internet*
  - *Top Hat*
- Prerequisites: 1323 and Mathematics 1523 or higher, both with a grade of C or higher
- Course web page:

  http://www.cs.ou.edu/~fagg/classes/cs2334/

How to Find Me

- Office: DEH 243
- Office Hours:
  - M/W 3:30-4:30
  - Also by appointment
- Email: andrewhfagg@gmail.com

How to find the TAs

All TA office hours in DEH 115 (computer lab)

Monique Shotande	monique.shotande@ou.edu
Manvir Kaur	Manvir.Kaur-1@ou.edu
Vishnu Medisetty	vishnuvikash@ou.edu
Stephen Thung	sthung@ou.edu
Sravani Veluru	sravani@ou.edu

Appointments can also be made

All of us can be reached simultaneously: cs2334@googlegroups.com

Course policies

Due Dates:

- Homework (Zyante exercises): start of class on the day assigned
- Projects: start of class (1:29pm) on the due date
  - Project 5 is different
- Labs: 48 hours after your lab section ends

Course policies

Late policy:

- Homework and labs cannot be turned in late for credit
- A project may be turned in late for a penalty:
  - 0 - 24 hours:10%;
  - 24 - 48 hours: 20%
- In-class exercises (Top Hat) and exams must be completed in class

Laptop Policy

- Labs: laptops are required
- Class:
  - May be used to program along with the rest of the class or to take notes
  - May want to use for Top Hat

If you are using your laptop in a way that distracts people around you in class, you will be asked to leave.

Tools

- Canvas: grade book, announcements, discussion, calendar
- Main course web site: http://cs.ou.edu/~fagg/classes/cs2334
- Catme: project group assignment (email coming)
- Zyante: on-line text book (details on web site)
- Top Hat: in-class exercises and discussion (email coming)
- Eclipse (Neon or Oxygen): integrated development environment
- Web-Cat: program submission and grading (details on class web site; login information coming soon)

Grading questions

- The item should be first brought to the person who graded it
- All grading questions must be brought to our attention within one week of when the item was returned
- Check your grades on Canvas

Getting the most out of class

- Read materials ahead of time
- Ask questions (in person or in Top Hat)
- Learn names of your fellow students (and use them)
- Participate in class discussions
- Participate in your group discussions
- Attend class regularly
- At the end of the semester, I should know your name

Appropriate Classroom Conduct

One rule: Respect

- Yourself
- Your peers
- The teaching team
  - Keep in mind: we are human, too, and we have many obligations

Inappropriate Classroom Conduct

- Allowing a cell phone or pager to repeatedly beep audibly.
- Playing music or computer games during class in such a way that they are visible or audible to other class members.
- Exhibiting erratic or irrational behavior.
- Behavior that distracts the class from the subject matter or discussion.
- Making physical or verbal threats to a faculty member, teaching assistant, or class member.
- Refusal to comply with faculty direction.

Classroom Conduct

- In the case of disruptive behavior, we will ask that you leave the classroom and I may charge you with a violation of the Student Code of Responsibilities and Conduct.
- If you have repeated disruptive issues, I will seek to withdraw you from the class.

This Week…

- Reading: email etiquette
- Next time: 1323 review
- Thursday Lab:
  - Preparation: install Java 8, Eclipse (Neon), Web-Cat plugin (into Eclipse)
  - Coverage: JDK, Compiling, Javadoc, Eclipse, Strings
  - Lab exercise is due on Saturday