Welcome!

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Overview for today

4:30-4:45  Introducing the class

4:45-5:00  Team A: Dr. Marc Melcher, Transplantation Surgery Presentation

5:00-5:15  Team B: Dr. Paul Wang, Cardiology Presentation

5:15-5:25  Coffee Time (Breakout in groups of 3 for socializing)

5:25-5:40  Continue course intro

5:40-5:50  Healthcare Has Left the Building

Don’t forget to record lecture

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Overview
This project-based course will provide a comprehensive overview of key requirements in the design and full-stack implementation of a digital health research application. Several pre-vetted and approved projects from the Stanford School of Medicine will be available for students to select from and build. Student teams learn about all necessary approval processes to deploy a digital health solution (data privacy clearance/IRB approval, etc.) and be guided in the development of front-end and back-end infrastructure using best practices. The final project will be the presentation and deployment of a fully approved digital health research application.

Course Website
https://cs342.stanford.edu
Canvas

Zoom Links
Zoom Recordings
Assignments

https://cs342.stanford.edu
Slack

direct message and
flexible communication

https://cardinalkit.slack.com/

https://cs342.stanford.edu
Post-Kidney Transplantation Management

Remote Cardiovascular Risk Management

https://cs342.stanford.edu
Team Cards
(syllabus)

A
Post-Kidney Transplantation Management

B
Remote Cardiovascular Risk Management

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CS 342 / MED 253 Building for Digital Health

Winter Quarter – Academic Year 2020/2021

Rev. 01.09.2021

As our world becomes more and more digitized, patients and their devices are generating streams of valuable data that can provide meaningful clinical insights. This digital health revolution provides great opportunities to design and validate new digital health concepts. Many groups within Stanford Medicine have promising ideas that are ripe for development, however, they lack the software engineering and healthcare compliance know-how to take them forward.

Building for Digital Health is a new Biodesign course sponsored by the Stanford School of Medicine (SoM) and Stanford’s Computer Science (CS) department. Its goal is to provide CS students with the opportunity to apply their skills to real-world health technology development projects, while enabling SoM faculty to leverage these talented individuals to help advance their technology concepts toward patients. Both audiences will learn a repeatable approach for developing new digital health technologies and preparing to launch them in the market.

Over the course of ten weeks, students and faculty will work together to tackle a project and launch an app-enabled solution for research use. Every week, students will learn about app-development, sensor technologies, privacy, security, and more. In the final week of class, teams will present their final project (app) to a panel of digital health experts.

GOALS FOR THE COURSE

- Gain exposure to unmet needs in the healthcare field and learn to design and build secure digital solutions to address them

- Get experience working with technical and multidisciplinary teams with the help of external mentors and industry experts who can help guide career paths in health tech innovation

- Become familiar with the iOS platform, the Swift programming language, the use of ResearchKit and other open-source frameworks, and secure data collection practices
What will you need to succeed in CS342?

You will need access to a mac for development. If you do not have a mac, the macs in residential clusters and at Lathrop (for checkout) come with Xcode pre-installed. You may also try a cloud solution such as macincloud.

Pull requests are a basic building block of contributing to open source code. In order to submit your code for grading, you will use Git.

Swift is the programming language that we will be using to build our apps. We will use the SwiftUI toolkit.

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</> learn by doing
we’ll be doing a lot of live coding
SwiftUI

Better apps. Less code.

SwiftUI is an innovative, exceptionally simple way to build user interfaces across all Apple platforms with the power of Swift. Build user interfaces for any Apple device using just one set of tools and APIs. With a declarative Swift syntax that’s easy to read and natural to write, SwiftUI works seamlessly with new Xcode design tools to keep your code and design perfectly in sync. Automatic support for Dynamic Type, Dark Mode, localization, and accessibility means your first line of SwiftUI code is already the most powerful UI code you’ve ever written.

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New to SwiftUI?
We will learn with [https://developer.apple.com/tutorials/swiftui](https://developer.apple.com/tutorials/swiftui)

```
import SwiftUI

struct ContentView: View {
    var body: some View {
        VStack(alignment: .leading) {
            Text("Turtle Rock")
                .font(.title)
            HStack {
                Text("Joshua Tree National Park")
                .font(.subheadline)
                Spacer()
                Text("California")
                .font(.subheadline)
            }
        }
        .padding()
    }
}

struct ContentView_Previews: PreviewProvider {
    static var previews: some View {
        ContentView()
    }
}
Our GitHub

includes starter and sample code for most of the topics that we cover in this class

https://github.com/orgs/cs342
Git is an industry standard for version control + code-sharing between projects and teams. Each team member **clones** a copy of the project code. Members can update this code on their machines, and then **commit + push** their changes. Other members can then **pull** the most recent changes and run everyone’s work so far all together!

GitHub is a popular hub for open source projects.

**CS342 is rooted in open source principles. Submitting an assignment is akin to contributing to a code base.**

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Submit your project preferences by this weekend!


Which project would you like to work on? *
We will use this application to form teams for the rest of the quarter.

- Project #1
- Project #2
- Other: __________________________
What is Open Source Software?

- Software with code made freely available for inspection, modification, enhancement, distribution.

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Developed with the goal of streamlining the process of gathering robust and meaningful data. Used to document patient-reported outcomes (surveys) and track a person’s reaction time, balance, gait, mobility, among many other things.

Developed with the goal of helping track the development of symptoms and adherence to medication over a period of time. Often used to help patients manage a particular health condition.

Using CardinalKit ([https://cardinalkit.org/](https://cardinalkit.org/))
Developed with the goal of providing a suite of tools to build and accelerate your digital health experience from the ground up — from an app itself to storing collected data in the cloud.

The Swift programming language that we will be using is open-source [https://github.com/apple/swift](https://github.com/apple/swift)

[https://cs342.stanford.edu](https://cs342.stanford.edu)
**Assignment #0: Trainings and Certifications**
Health research requires adherence to strict security and privacy protocols, and Stanford requires researchers working in this area to obtain specific certifications. These certifications will enable students to work on other IRB-approved research, and is a requirement for most research within the School of Medicine.

**Week One**
- Submit your project preferences by Jan 15th (Friday). We will share results shortly after.
- Meet with your team by Jan 22nd.

**Assignment #1: Hello World  - INDIVIDUAL -**
Set up Xcode, create a basic SwiftUI app, and submit via GitHub.

**Assignment #2: ResearchKit + Firebase**
Learning how to use ResearchKit and the Google Cloud Platform (GCP).

**Assignment #3: Midterm Presentation & App (alpha)**
Each team will work together to create one app for their project.

**Assignment #4: App (beta)**
Getting your apps tested and ready for launch.

**Assignment #5: Final Presentation & App launch! 🎉**
Launch day!
Grading will be based on:

10%  Attendance
10%  Individual and team class participation; project teams must share presentation responsibilities.
30%  Assignments (and code review)
20%  Midterm Presentation due on February 11th. All team members must be present.
30%  Final Presentation and Deliverables (10-15 slides) due on March 18th. All team members must be present. The slide deck (powerpoint or pdf) must be submitted in advance and no later than 11:59PM on March 17th. Code must be submitted on the last day of class via GitHub. *(HIPAA training certificate is also part of the final presentation grade!)*

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Guest lecture by Dr. Ricky Bloomfield, Apple

Guest lecture from Erik Hornberger / Gavi Rawson, CareKit, Apple

Guest lecture from Dharmesh Patel, Google

Guest lecture with live-coding from Alex Astrum, Google
Syllabus Overview
Coffee Time

- 10 min
- Opportunity to mingle / take a break
- Ice breaker question for the day:

“What is something that people find surprising about you?“

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Health Care Has Left the Building
Unsustainable trajectory…

• **Costs**
  - US spends 17% of GDP on healthcare ($3.6 Trillion in 2018)
  - Costs continue to increase by 5.5%/year

• **Poor outcomes, comparatively**
  - Outcomes not as good as countries that spend 2/3 less than we do
  - Japan life expectancy 84 years, US 79 years

• **Aging Society**
  - More people requiring care and fewer people paying into system

• **Not enough clinicians**
“Triple Aim”
Institute for Health Improvement

• New innovations must pursue these three dimensions
  • Improved patient outcomes
  • Lower cost
  • Scalable to population
Digital Health Definition

**Digital health** is the convergence of patient data, connectivity and computing power to increase access and provide personalized healthcare to improve outcomes at a lower cost.