Welcome!

https://cs342.stanford.edu

Santiago Gutierrez
Oliver Aalami

Fall 2019
Overview for today

- Introducing the class
- Syllabus overview
- Introducing our projects for this quarter
  - Guest lectures from Dr. Seshdari Mudumbai (S-SMART team) + Dr. Lance Downing & Dr. Nick Bott, PsyD (ACP team)

https://cs342.stanford.edu

cs342-aut1920.slack.com
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 designs 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, computing power and the provider to increase access and provide more personalized healthcare to improve outcomes and lower cost.
Digital Health Framework

Data Sources

Data

Insights

Applications

Mobile/Patient Apps

Devices / Wearables / Sensors

Hospital / Clinic / Pharmacy

EHR, PACS, Claims, Pharma, Labs, PRO, Behavioral etc.

DATA

Computational (analysis, AI/ML) / Human (consultation, case review)

ANALYSIS

Population Health
(e.g., Population Risk Assessment, Health Analytics/Economics, Clinical Workflow, Non-clinical workflow, Health Benefit Admin, Research)

VALUE

Patient level / Precision Health
(e.g., Consumer Health Info/Concierge Service, On-demand Service, Dx, Virtual Care, Digital Rx, Care Coordination, Wellness, Clinical Decision Support)

Feedback Loop
Ochsner O-Bar
Digital Health Interventions

- Hypertension management
- CHF Management
- Diabetes management
- Pregnancy Program (pre-eclampsia)
Digital Hypertension Management Program

- SBP >140 or DBP >90 x 3 visits
- Place order from within EPIC
- Pt. goes to O-bar to pick up connected BP Cuff
- Instructed to measure BP at least 1/week
- Pharmacists reviewed data weekly
- Pharmacist adjusted BP meds weekly per protocols
- At 90 days 71% digital medicine vs. 31% usual care achieved goal BP

Apple Heart Study

- Study used to get FDA approval for Irregular Rhythm Notification (IRN) algorithm

Consort Diagram

- Overall Cohort: Total Population 419,297
  - Pulse Notification: 2,161 (0.5%)
    - First Study Visit: 945 (44%)
      - At SV1: 291 (31%)
        - Emergent symptoms: 20
        - Prior AFib or flutter: 174
        - Current Anticoagulant use: 90
        - Other reasons: 33
    - ECG Patch Shipped: 658 (70%)
    - ECG Patch Returned & Analyzed: 450 (68%)
  - No Notification (PN): 417,136 (99.5%)
  - Completed 90-day Survey: 1,376 / 2,161 (64%)
  - Completed EOS Survey: 929 / 2,161 (43%)

ACC, New Orleans, March, 2019
2018 FDA Cleared for software workflow tool: Intracranial Hemorrhage Detection

Accipiolx is a software workflow tool designed to aid in prioritizing the clinical assessment of adult non-contrast head CT cases with features suggestive of acute intracranial hemorrhage in the acute care environment. Accipiolx analyzes cases using an artificial intelligence algorithm to identify suspected findings. It makes case-level output available to a PACS/workstation for worklist prioritization or triage.

Accipiolx is not intended to direct attention to specific portions of an image or to anomalies other than acute intracranial hemorrhage. Its results are not intended to be used on a stand-alone basis for clinical decision-making nor is it intended to rule out hemorrhage or otherwise preclude clinical assessment of CT cases.

Business model: Quality Assurance
What if your “user” is the 8-headed monster called healthcare?
To deal with this complexity …

“The Biodesign Process”
A well-characterized need is the DNA of a great invention!
First Step: Create a Need Statement

A one sentence, *solution-independent* statement that describes:

- The *problem* you’re seeking to address
- The *population* it affects
- The *outcome* you’ll achieve by solving the problem

Typically:

“…a way to (solve a problem) in (a given population) to (create a specific outcome)”.

© 2016 Stanford Byers Center for Biodesign
Needs Statement

A way to solve a specific problem...

in a well characterized population...

in order to achieve a measurable outcome
Sample Need Statement for Zio Patch

A better way to detect potential rhythm disturbances

... in non-hospitalized patients with suspected arrhythmias

... to improve the patient experience and reduce the cost of diagnosis.

problem... population... outcome
Syllabus Overview
Overview for today

- Introducing the class
- Syllabus overview
- Introducing our projects for this quarter
  - Guest lectures from Dr. Seshdari Mudumbai (S-SMART team) + Dr. Lance Downing & Dr. Nick Bott, PsyD (ACP team)

https://cs342.stanford.edu

cs342-aut1920.slack.com
Building for Digital Health

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
Biodesign’s Building for Digital Health (MED 253/CS 342)

Building a clinical research study app at Stanford
Autumn Quarter 2019-20, 3 Units
Tuesday/Thursday 4:30-5:50 pm
• Required

Student Application

Your goal will be to design, test, and implement a digital solution for an important unmet medical need. We will be forming groups of 2-3 engineering students and pairing each with a project + professional clinical faculty from the Stanford School of Medicine.

Here’s a glimpse of the types of projects you would potentially be working on:
Development of a Population-Level, Smartphone or Wearable Surveillance App to identify Patients at High-Risk for Persistent Post-Operative Opioid use
Improving value in late life: engaging patients and families in advanced care planning
** see below for more detailed descriptions of projects **

We are looking for highly motivated students who have an interest in health applications. We recommend that you consider this course if you have experience creating mobile applications (iOS, web-apps (react, angular), or RESTful web servers (golang, nodejs). We will help you think in terms of the full-stack, but it’s okay if you want to primarily develop your skills in just one.

With that said, a strong coding background will help you pick up the concepts that we will be teaching in class as we move along — but you will need to put in some extra time to learn the intricacies of mobile dev, which the course will not teach.

You may contact Santiago Gutierrez (santiq@stanford.edu) to discuss the course or technical expectations in advance of submitting your application.

Application Closes: September 27
Application Decision: September 28

Application

https://forms.gle/HxCvNJqnhygwqs3g8
Slack

direct message and
flexible communication

cs342-aut1920.slack.com
CS 342 / MED 253 Building for Digital Health

Fall Quarter – Academic Year 2019/2020

Rev. 09.23.2019

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 research-ready frameworks, and secure data collection practices

View our Syllabus:
Apple Heart Study

• Study used to get FDA approval for Irregular Rhythm Notification (IRN) algorithm
Consent
visual templates with best practices and a transparent process

Surveys
collect feedback and patient-reported outcomes

Active Surveys
measure body activity using iPhone sensors

More
login flows, passcode creation, charts, etc.

+ activity monitoring

motor activities, fitness, cognition, speech, hearing, hand dexterity, and vision
you will need access to a mac
learn by doing

we'll be doing a lot of live coding
Our GitHub includes starter and sample code for most of the topics that we cover in this class

https://github.com/orgs/cs342
Guest Lecture from Steve Hershman, Director of mHealth

Guest lecture by Dr. Ricky Bloomfield, Apple

Guest Lecture by Srinath Muralidharan, Apple

Guest Lecture Jonathan Wilt
CTO Ochsner Health System, LA

Guest Lecture, Google Cloud Platform team
Grading will be based on:
10% Attendance
10% Individual and team class participation; project teams must share presentation responsibilities.
15% Code Review (two check-ins); meetings outside of class to discuss GitHub progress.
15% Midterm Presentation due on Thursday, October 24. All team members must be present.
50% Final Presentation and Deliverables (10-15 slides) due on Thursday, December 5. All team members must be present.

https://cs342.stanford.edu

cs342-aut1920.slack.com
Assignment #1
submit your project preference [link]

Assignment #2: Getting Started
Install Xcode & join our GitHub

https://cs342.stanford.edu
cs342-aut1920.slack.com
New to iOS development?

- Familiarize yourself with Swift
- Complete Building the UI before Oct 1st
- Complete Working with Table Views before Oct 15th

share solutions with our TAs during office hours — we’ll help get you up to speed.

Assignment #1
submit your project preference [link]

Assignment #2: Getting Started
Install Xcode & join our GitHub

https://cs342.stanford.edu

cs342-aut1920.slack.com
Overview for today

- Introducing the class
- Syllabus overview
- Introducing our projects for this quarter
  - Guest lectures from Dr. Seshdari Mudumbai (S-SMART team) + Dr. Lance Downing & Dr. Nick Bott, PsyD (ACP team)

https://cs342.stanford.edu

cs342-aut1920.slack.com
A better way for clinicians and patients to monitor risks associated with pain/opioid-use after hospital discharge in pre- & post-operative VA and Stanford healthcare system population patients to create an early intervention tool tracking medication use and evaluating patient pain/sleep/daily functioning informing both Clinicians and Patients to minimize re-admittance.
CARE-IT Problem Statement

A way to improve patients understanding, expression, and sharing of advanced care wishes for everyone to improve the rate of advanced care planning documentation, enhance patient experience, and reduce friction in sharing these wishes
[title]

- [text]