# The Harvey Mudd College Clinic Program

*R. Michael Shanahan Center for Teaching and Learning Claremont, California*

**Celebrating Mudd's 57th year of Clinic**

HARVEY MUDD COLLEGE

# What is Clinic?

- Sponsored capstone-project course
  (taken by all senior Math+CS majors)

- Starts in September, ends in May

- 10+ hrs / student / week
  (1200-1500 hours in total)

- Sponsors own all IP

Team of 4-5 students, delivering on an open-ended project
with a faculty advisor, sponsor, and sponsor's liaison(s).

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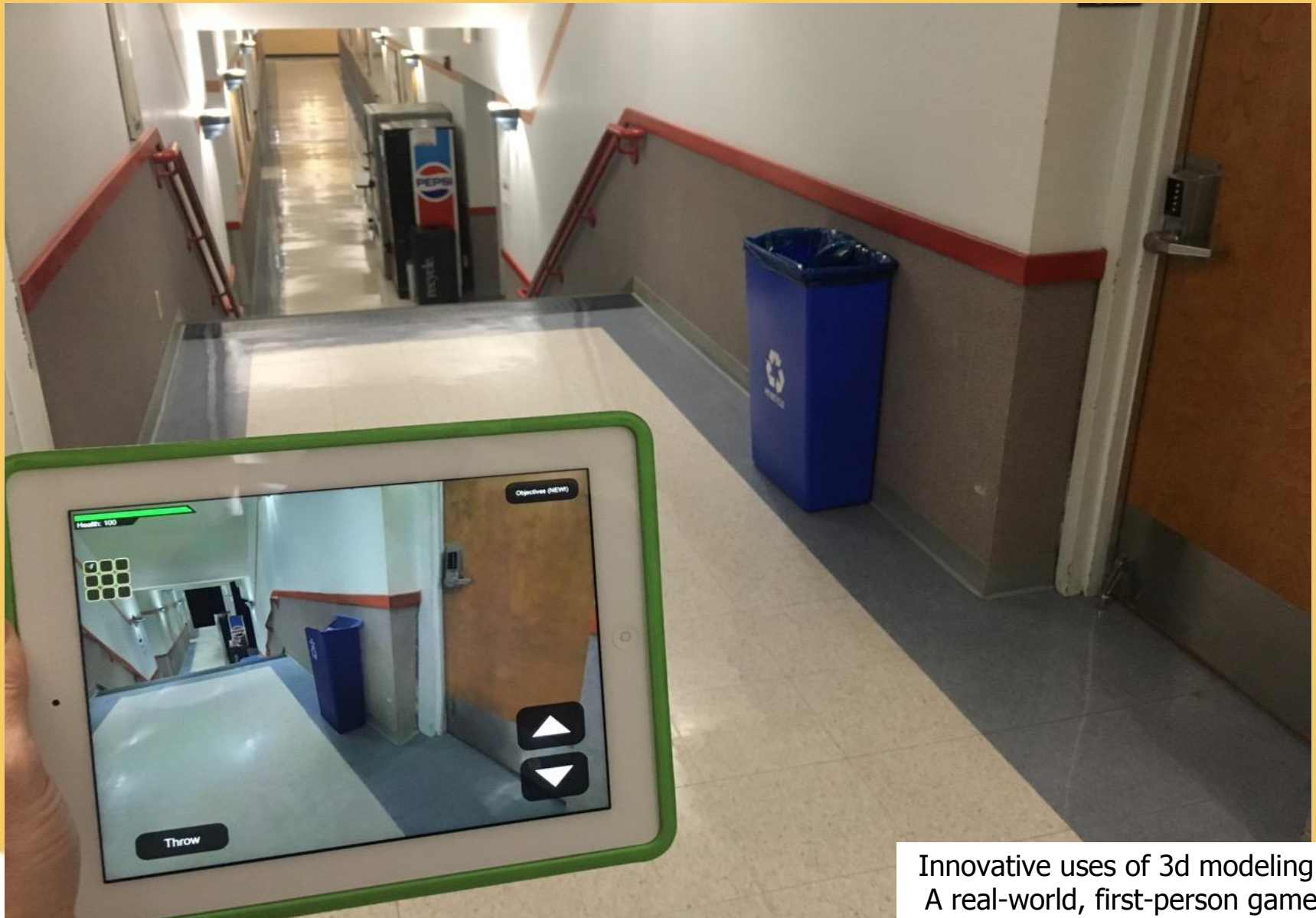Team of 4-5 students, delivering on an open-ended project



Matterport:  a custom-designed 3d game



Fluxergy:  cellular image-processing

# Example: Matterport



Innovative uses of 3d modeling:
A real-world, first-person game

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Pure Storage:   file-system capabilities



Jones Parking:   targeted start-up-teaming

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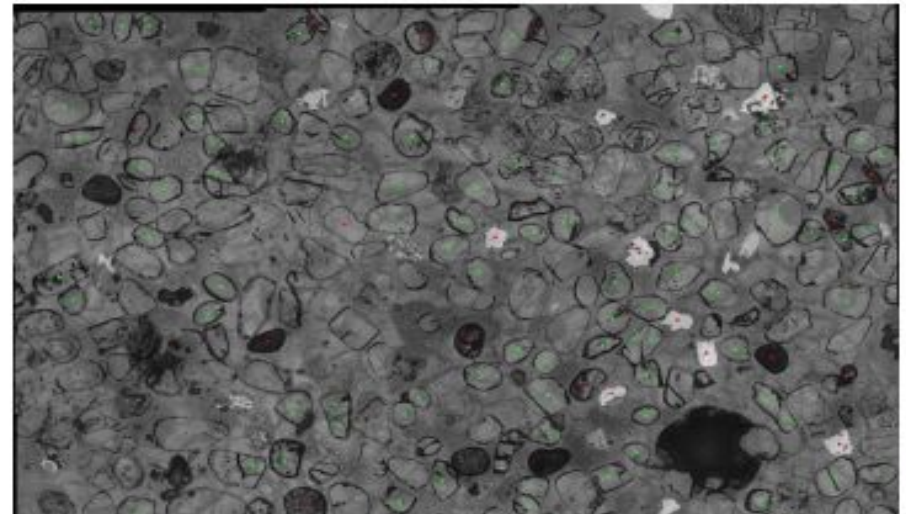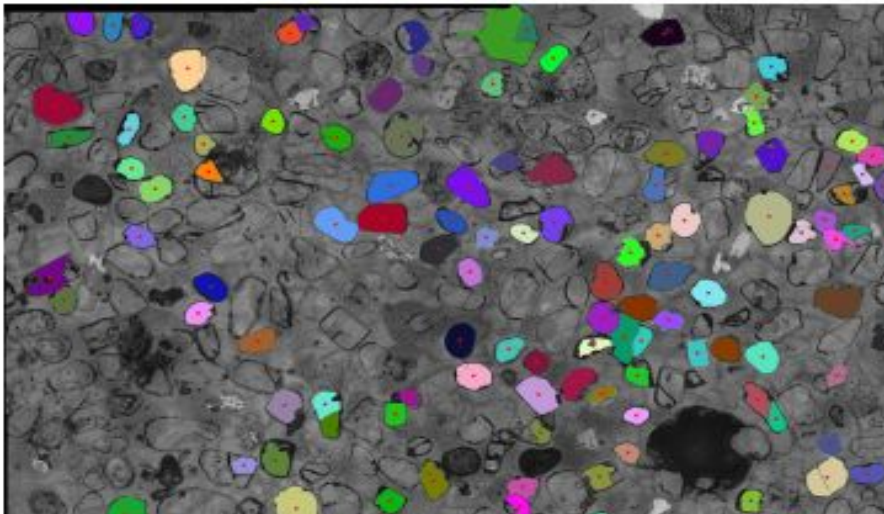Team of 4-5 students, delivering on an open-ended project
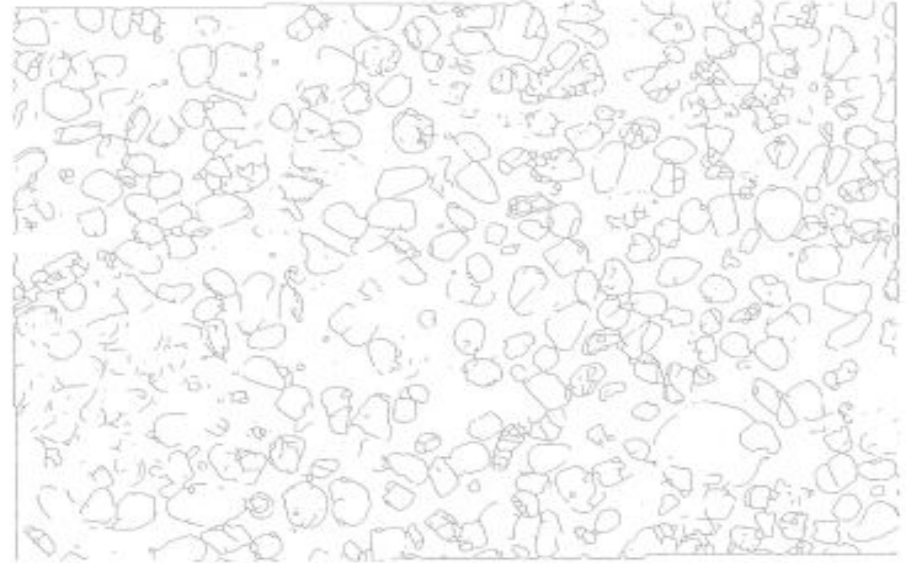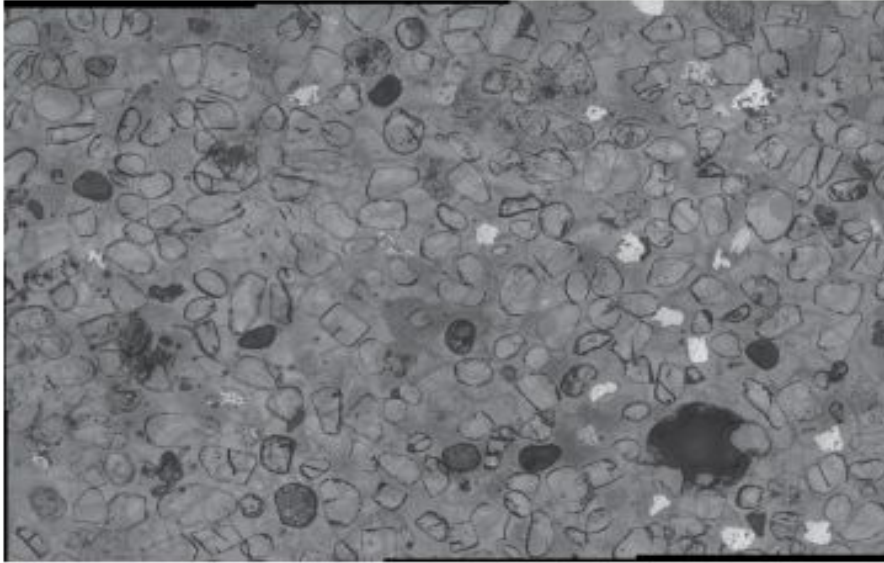


Microsoft:   confident reading, by everyone



Verkada:  live-stream computer vision + ML

# Example: Computer Vision



An energy- and geology-motivated clinic: finding $^{235}U$ fission tracks in apatite-to-zircon crystals

# Clinic Sponsor Commitment

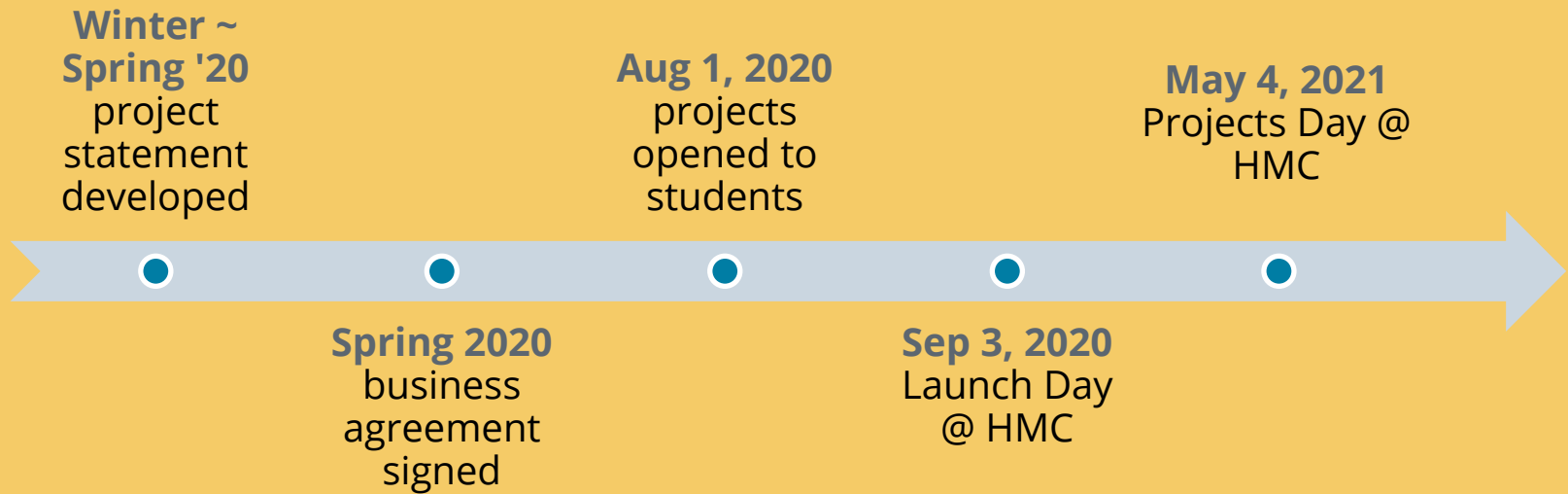| | |
|---|---|
| Project Statement | *1-2 pages ~ sponsor, <u>vision</u>, problem, deliverables* |
| Business Agreement | *~3 pages, responsive, confidentiality as desired* |
| Fee | *$52,000 (divided into three payments)* |
| Feedback | *Throughout. Externally, at the project's end* |
| Liaison(s) | *Approximately 1-2 hours per week ~ "Aligner"* |

# Clinic Timeline
## Key Dates: 2020-2021

**Winter ~ Spring '20** project statement developed

**Spring 2020** business agreement signed

**Aug 1, 2020** projects opened to students

**Sep 3, 2020** Launch Day @ HMC

**May 4, 2021** Projects Day @ HMC

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# **Value to Sponsors**

- **80%** of 2018-19 clinic sponsors said that their project was **"a success"**

- In 2019,  **4 patent disclosures** were reported by Clinic sponsors

- More than 60% of 2018-19 sponsors estimated the **value of their project** to their company at $100,000 or more

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# Value to Sponsors & Students



MITRE's team and poster @ Projects Day.   *Recruiting / Re-visioning*

# Value to Sponsors & Students

Final presentations @ Projects Day. *Collaboration breadth*



then (2006)

now

# Value to Sponsors & Students



¾ of AmEx's team @ NYC site visit

*Experience + Engagement*

# Mudders: bright, inventive, fearless



**Harvey Mudd College**

Claremont, CA

#1 in Engineering Programs (no doctorate) (tie)

0 user reviews

Harvey Mudd College is a private liberal arts school known for its strong programs in math, science, and engineering. Harvey Mudd is lo ...more

$56,876 Tuition and Fees | 844 Undergraduate Enrollment | 4.6 Reputation Score | SAT, GPA and more

*U.S. News and World Report*
#1 – Engineering ~ undergrad
#3 – Campus Ethnic Diversity
#18 – Liberal Arts Colleges

*Princeton Review*
#3 – "Students Study the Most"
#3 – "Most Accessible Professors"

*Forbes*
#3 – Top 25 STEM Colleges
#5 – Top Liberal Arts Colleges

# Mudders: bright, inventive, fearless

Highly Selective Liberal Arts College

- 886 students
- 87% of incoming students were top 10%
- Competition:  Stanford, MIT, Caltech
- *Siblings*:  CMC, Scripps, Pitzer, Pomona

30% of seniors go directly to graduate school

Ranked #2 in science + engineering Ph.D.s

Harvey S. Mudd,
mining engineer

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# *Engaged*:  Global + Local Clinics

## Global Clinics

- 1-2 projects per year, since '05
- International partner (corporate/NGO)
- Academic partner optional

## Social Justice Clinics

- New in 2018-2019
- Non-profit partners
- Social impact through technology ~ *with a clear understanding of the impact of their work on society*



The CareFusion Clinic Team designed, built and tested a low-cost, high-performance IV infusion delivery system specifically targeting developing healthcare markets.

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# Clinic ~ Areas of Focus

## Computer Science

*What's next?* Exploratory toolsets
Re-imagined workflows, inside / out

Data science, modeling, analysis
User experience: UI/UX development
Machine Learning of all sorts
(Deep) NN and AI / Robotics

Image processing and Computer vision
Threat detection, Cybersecurity
Algorithm + Scenario development
Domain-specific languages + portals
Task-process streamlining/"new eyes"
Investigative software engineering

## Mathematics

System modeling + prediction
- ➢ topic modeling
- ➢ approximate +/- exact
- ➢ analysis + accuracy

Operations research / optimization

Data analytics (any size!)
- ➢ human-interpretability
- ➢ software interfaces

Energy & Environment
- ➢ visualizations
- ➢ outreach

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Explore, prototype & align new, emerging ideas

# 2018-2019 Sponsors



Computer Science, Engineering, Global, Mathematics and Physics Clinic Sponsors 2018 - 2019

# *Projects ...*     **Possible Paths**

- Speculative *"unerased-whiteboard"* ideas
  - *" If we had one more FTE... or team "*

- Valuable, not critical-path

- There's no typical Clinic project:
  - *" R + D for our R & D "*
  - *" Optimizing – along a new axis "*
  - *" Exploring our hackathons' 2-5% ideas "*
  - *" An internally incubated start-up... "*

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*Thoughts?*

# 2018-2019 Sponsors

AT&T · accenture · AHMEDABAD UNIVERSITY · ARVIND FASHIONING POSSIBILITIES · ATI · apache cassandra · Booz | Allen | Hamilton®

3DS BIOVIA · City of Hope. · Claremont CLGP · DOOSAN · Bobcat · EDR® · Fresno Metro Black Chamber of Commerce · FLUXERGY

+GF+ · Google · HARVEY MUDD COLLEGE · GKN · hp · HRL LABORATORIES

intuit · INTUITIVE · leidos · Lawrence Livermore National Laboratory

MEGGITT smart engineering for extreme environments · intel Sports · Computer Science, Engineering, Global, Mathematics and Physics Clinic Sponsors 2018 - 2019 · Microsoft · MOOG

Mentor A Siemens Business

MIT LINCOLN LABORATORY · MILLENNIUM SPACE SYSTEMS · McKay Brothers · niagara BOTTLING, LLC · New Relic. · OpenX

PilotCity · servicenow.

Sandia National Laboratories · Proofpoint · PURE STORAGE® · SANBORN · SIEMENS Ingenuity for life · ScreenPortal

Steelcase · TECHMATION Innovation in Motion · Tradeweb · TOYOTA · Virgin ORBIT · VERKADA · WEBROOT SecureAnywhere®

# 2017-2018 Sponsors

Clinic Sponsors
2017-2018

# 2016-2017 Sponsors

# 2015-2016 Sponsors
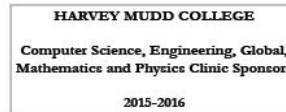
# More information

**hmc.edu/clinic**
**clinic@hmc.edu**

[ relationships matter ]

The remaining slides provide additional context – they're not part of our in-person presentations, unless they turn out to help…

[ relationships matter ]

# The Year's End:  Projects Day



GoDaddy team's presentation

# Year's End:  Projects Day



AmEx team's dinner

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# and beyond…

AmEx team's visit

# The Year's Rhythms: Orientation Day

- Liaisons invited to campus

- Meet with Clinic Director
  - Strategies and tips

- Meet with team and faculty advisor
  - Cover problem in detail
  - Discuss confidentiality

- Establish communication routine
  - Email/Slack/other
  - Weekly teleconferences

- Jumpstart the project, face-to-face

- Recruiting / internship opportunity



inside a weekly telecon

# Example clinic projects



MIT LL Imaging team

# Mudd:  depth, rigor, and breadth

## HMC's Common Core
(semesters)

| | |
|---|---|
| 1 | Biology (+ associated lab) |
| 1.5 | Chemistry (+ associated lab) |
| 1++ | Computer Science |
| 1 | Engineering |
| 1 | Critical Inquiry (Humanities, Social Sciences, and the Arts) |
| 3 | Mathematics |
| 2.5 | Physics (+ associated lab) |
| .5 | Writing |

Major requirements

10 HSA
(Humanities, Social Sciences, and the Arts)

Common Core

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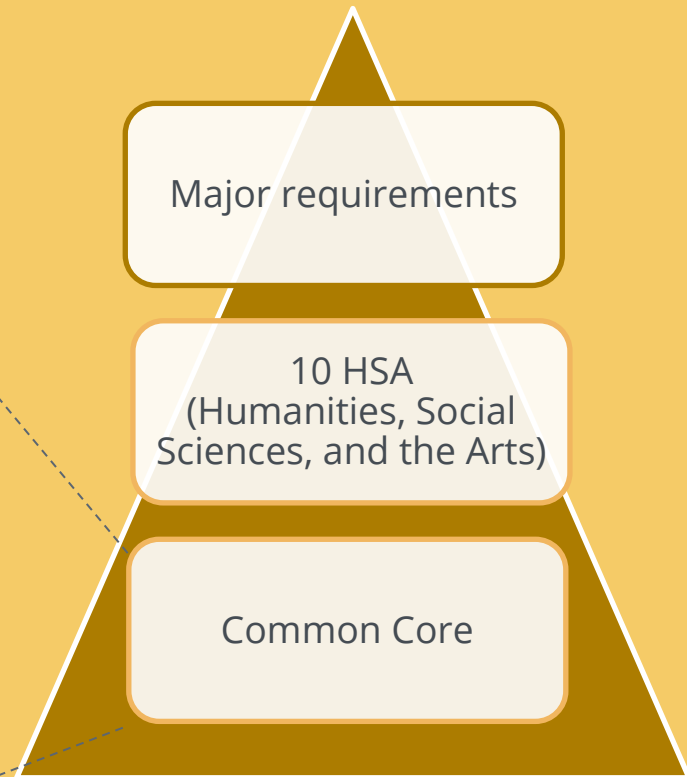
# Past clinics ~ areas of focus

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Threat detection, Cybersecurity
Algorithm development + assessment
Domain-specific languages + portals
Work-process streamlining/"new eyes"
Investigative software engineering

## Engineering

Design & testing
Mechanical/Structural

Embedded Systems + Robotics
Systems & Signals, Controls

Biomedical, Aerospace,
Automotive, Manufacturing,
Process engineering, Materials

(Bio)Chemical Engineering

Energy & Environment

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Explore, prototype & align new, emerging ideas

# Past clinics: areas of focus

## Mathematics

Process analytics

Data science

Neural networks

Pricing modeling and optimization

Data mining

## Physics and Biology

Quantum processing

Nanoparticles

Optics

Photovoltaics

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