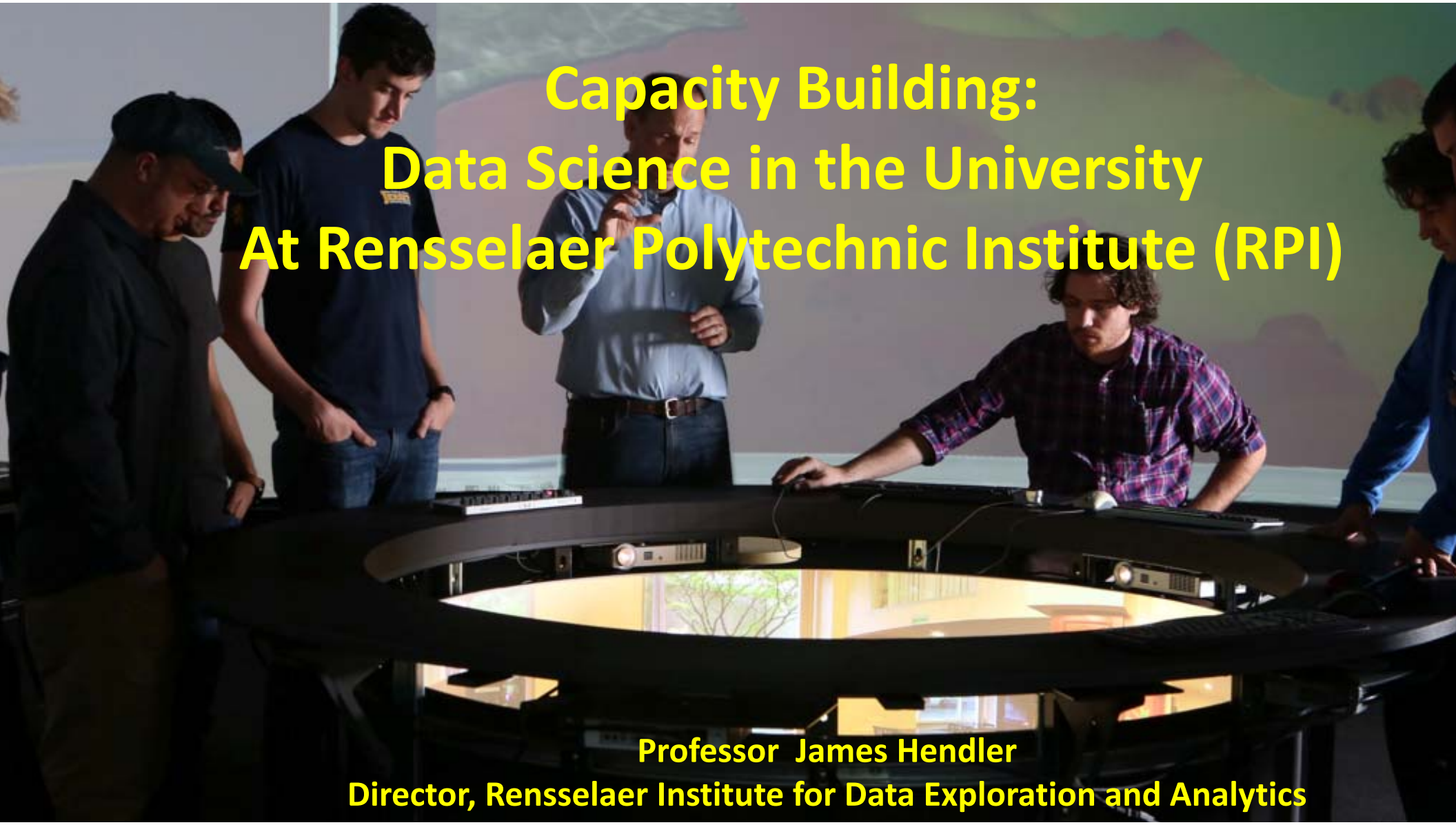


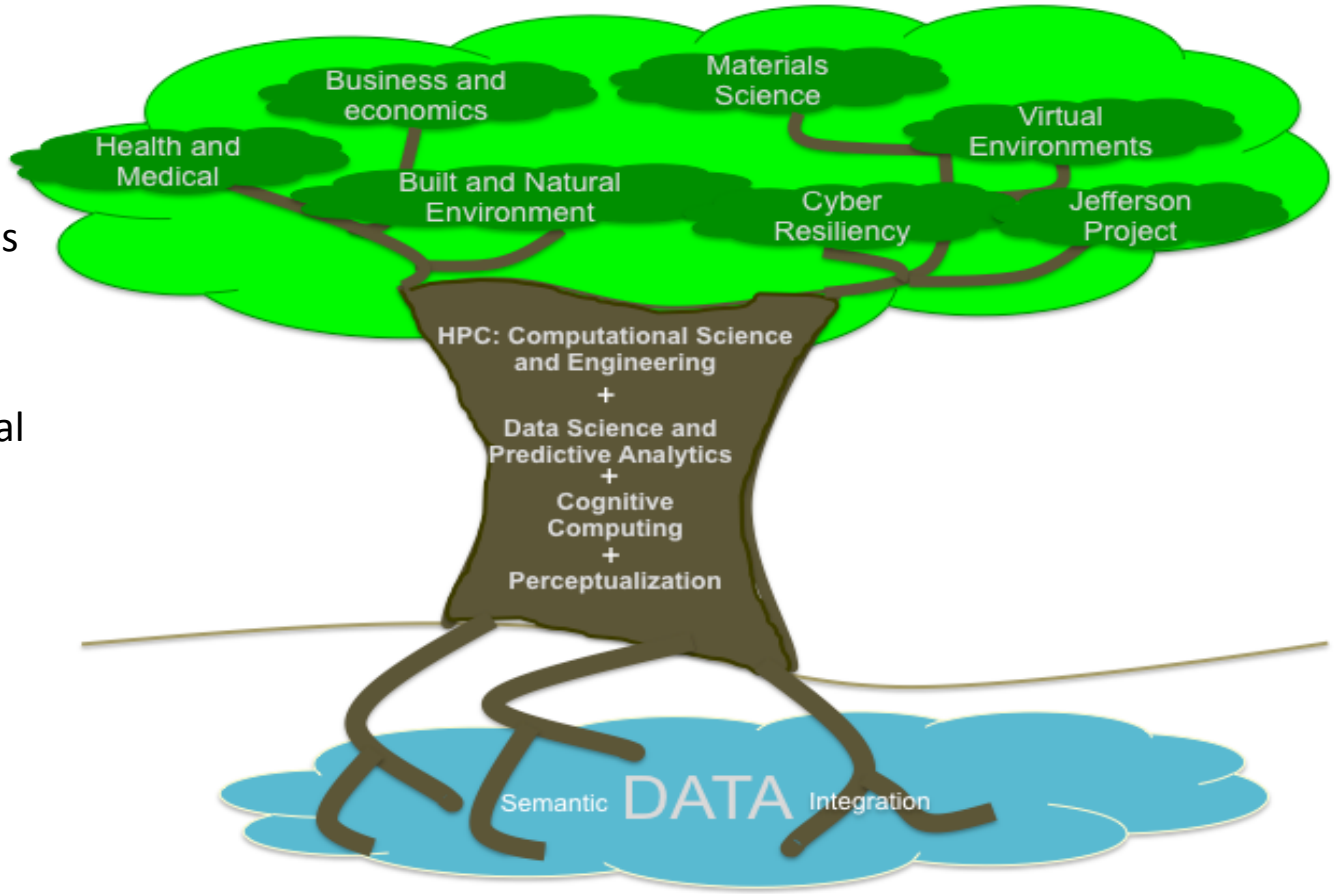
Capacity Building:
Data Science in the University
At Rensselaer Polytechnic Institute (RPI)

Professor James Hendler
Director, Rensselaer Institute for Data Exploration and Analytics

The Rensselaer IDEA

why not change the world?

- Institute for
  - Ubiquitously linked to everything at Rensselaer; potentiating major strengths
- Data
  - The basis of the 4th Industrial Revolution
- Exploration &
  - **Leading in advancing "data science" through basic research**
- Applications
  - Linked to global challenges



Data Dexterity Requirement

March 22, 2018

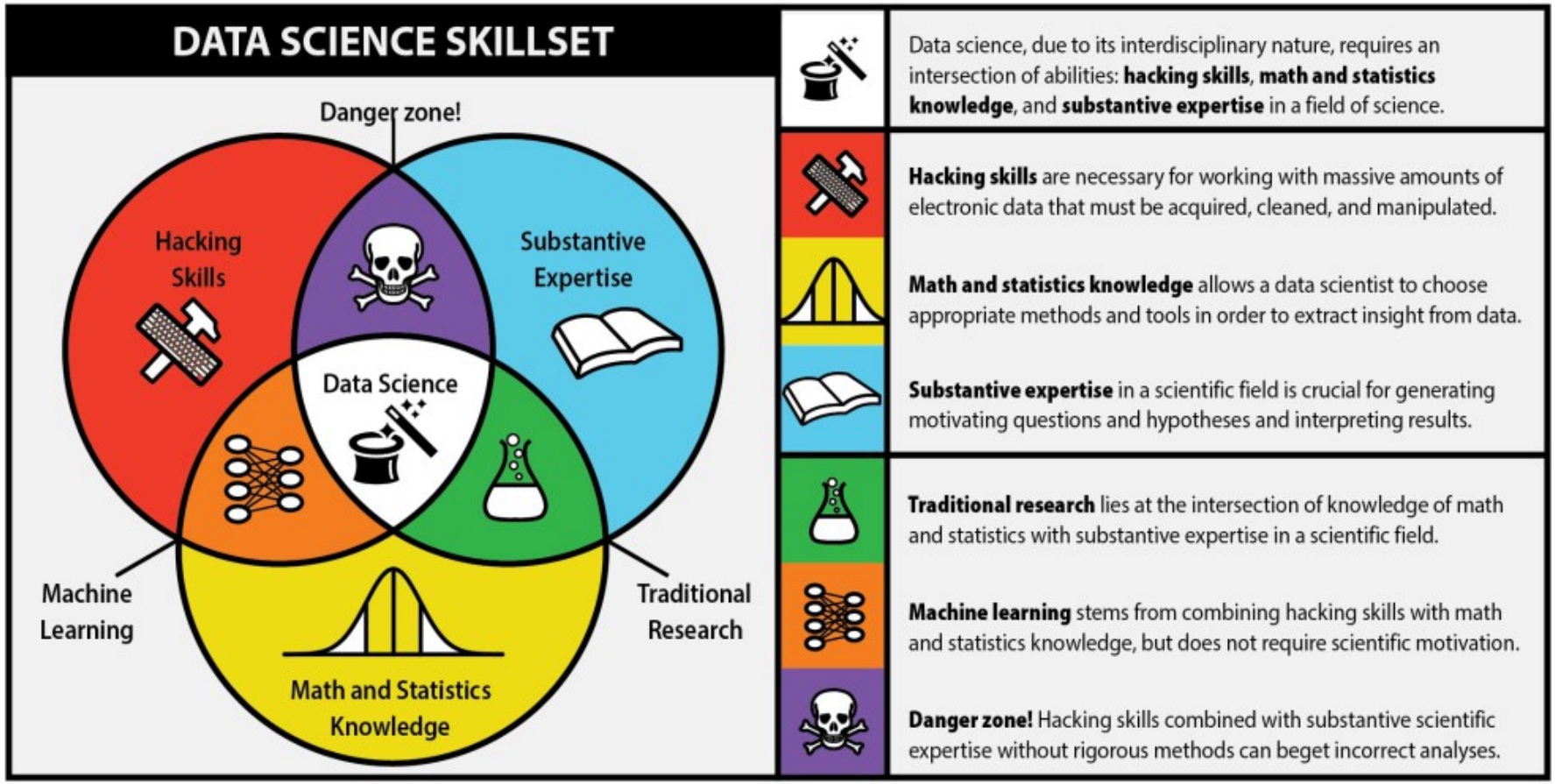
Rensselaer Introduces First in the Nation "Data Dexterity" Requirement for All Undergraduate Students

Requirement prepares students in all disciplines to use datasets to define and solve complex real-world problems

By Mary L. Martialay

- Objectives for Data Dexterity
  - Identify different types of data, information and evidence within the relevant discipline, and be able to discuss issues of data curation, validation, and uncertainty.
  - Identify appropriate problems to which data can be applied, and discuss limitations, assumptions and interpretations.
  - Effectively communicate about problems/issues in this field in which data is a relevant tool, including writing about, presenting on, and visualizing data
  - Discuss the ethical issues surrounding data in this field, including, but not limited to, responsible conduct of research, privacy, provenance, privatization, monetization, social implications

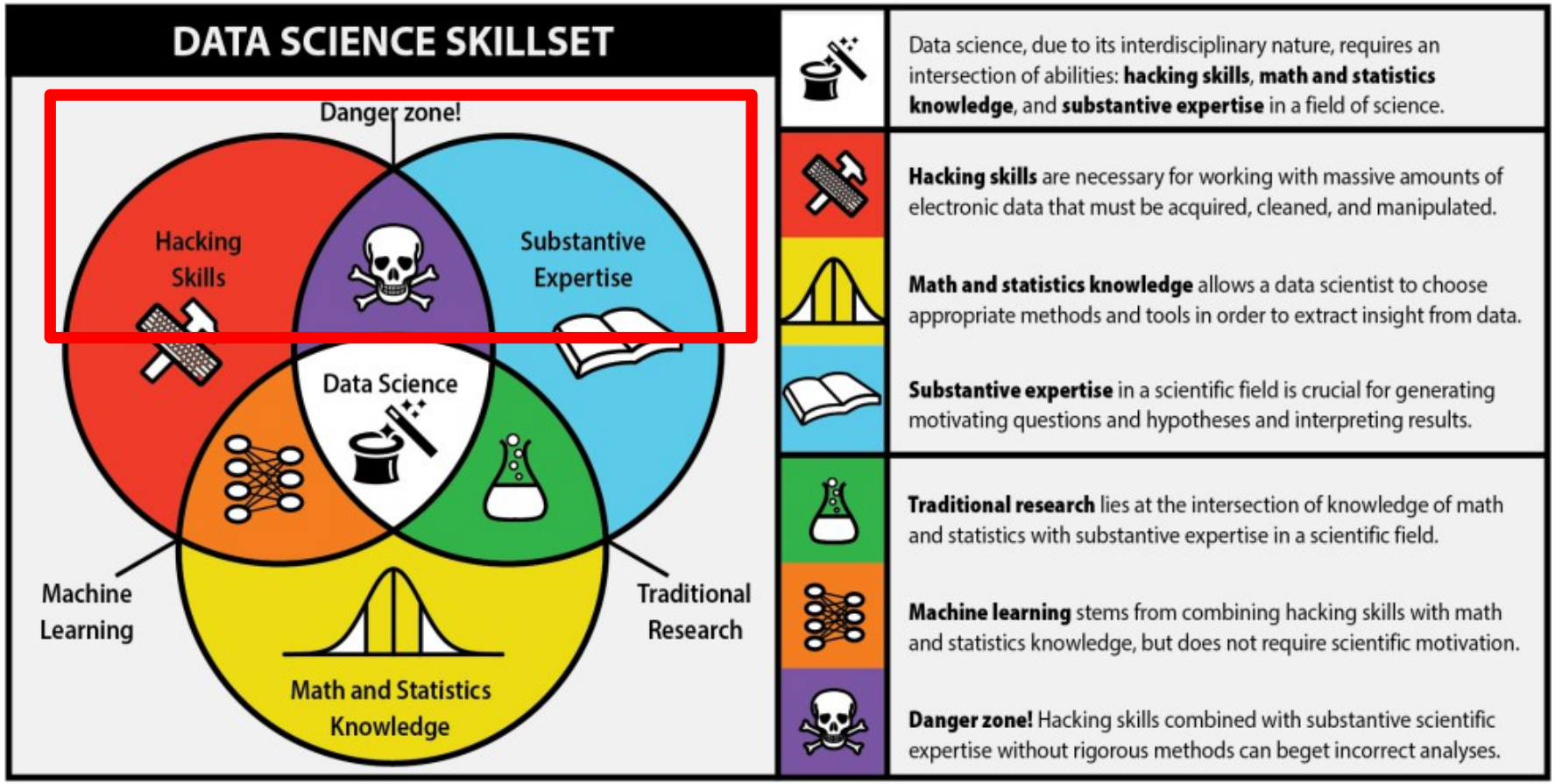
Drew Conway's 2013 Venn Diagram



Version from Berkeley Science Review: http://berkeleysciencereview.com/article/first-rule-data-science/

JH1
JH2

The "danger zone"



Version from Berkeley Science Review: http://berkeleysciencereview.com/article/first-rule-data-science/

Slide 6

JH1 James Hendler, 11/06/2018

JH2 James Hendler, 11/06/2018

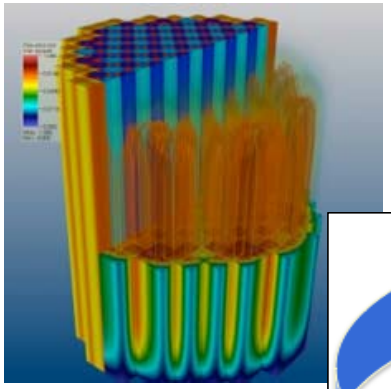
Teaching Data Science

- Science and interdisciplinary from the start!
  - Not a question of: do we train scientists to be technical/data people, or do we train technical people to learn the science
  - It's a skill/ course level approach that is needed
- Teach methodology and principles over technology
- Data science is a *skill*, and natural like using instruments, writing/using codes
- Team/ collaboration aspects are key
- Foundations and theory must be taught

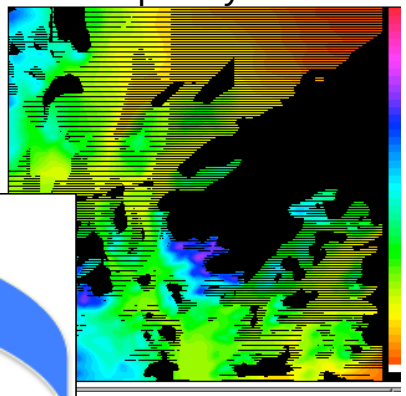
Lessons learned from Peter Fox
https://www.slideshare.net/brandsteve/data-science-for-every-student-at-rpi

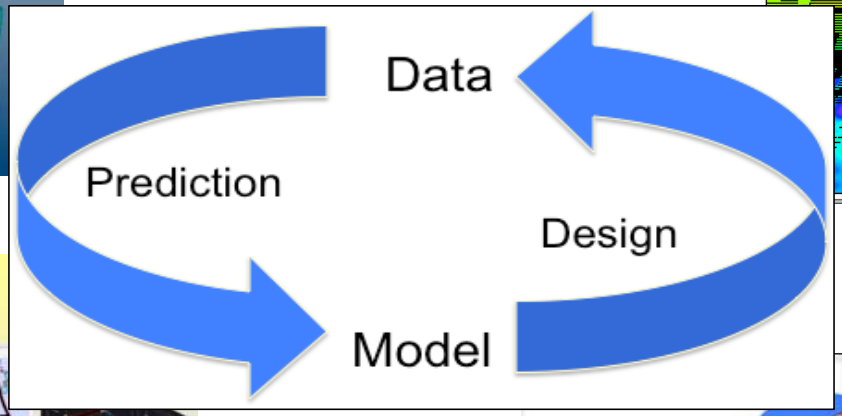
Foundations must be taught

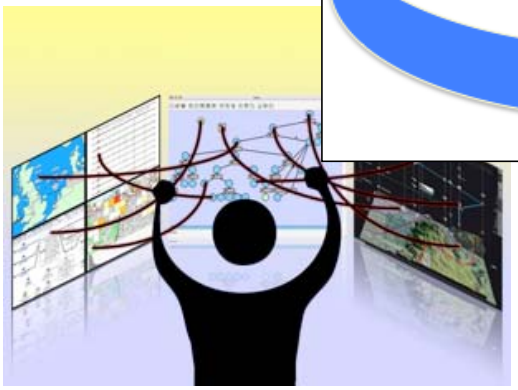
Multiscale



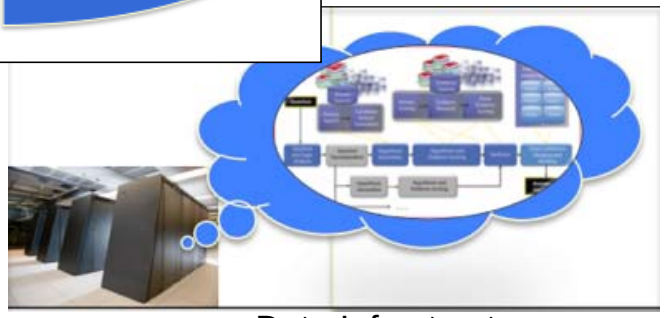
Sparcity





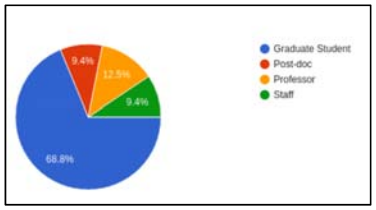


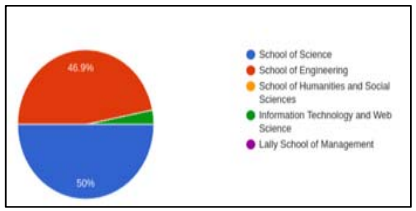
Abductive

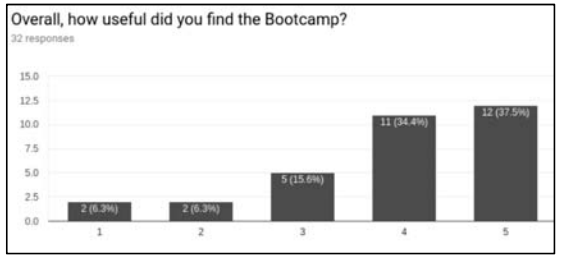


Data Infrastructure

Hands on experience is crucial

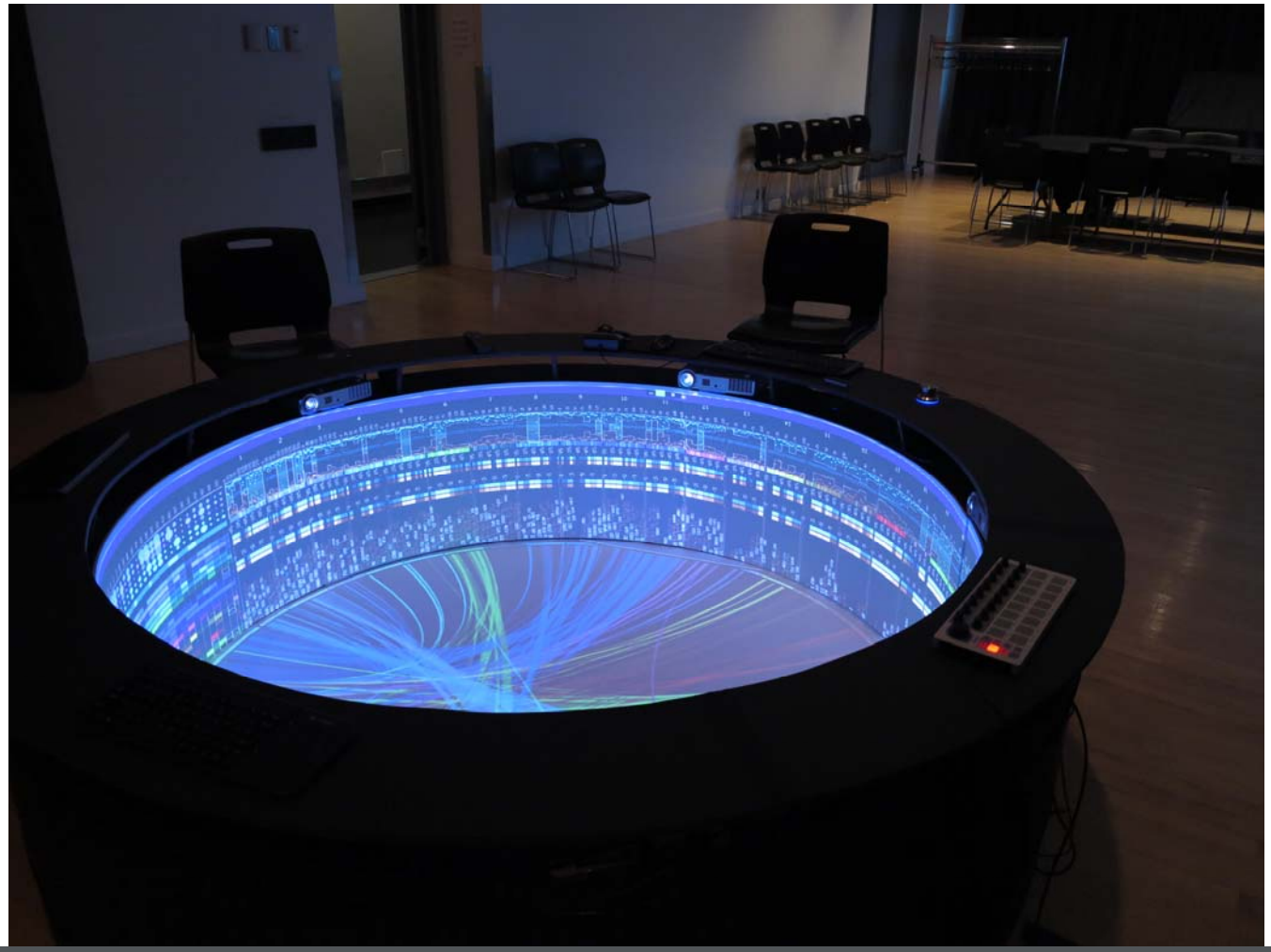


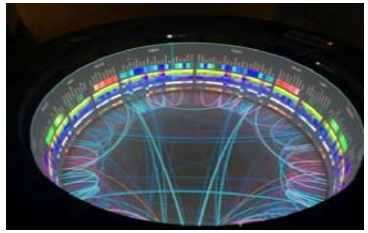




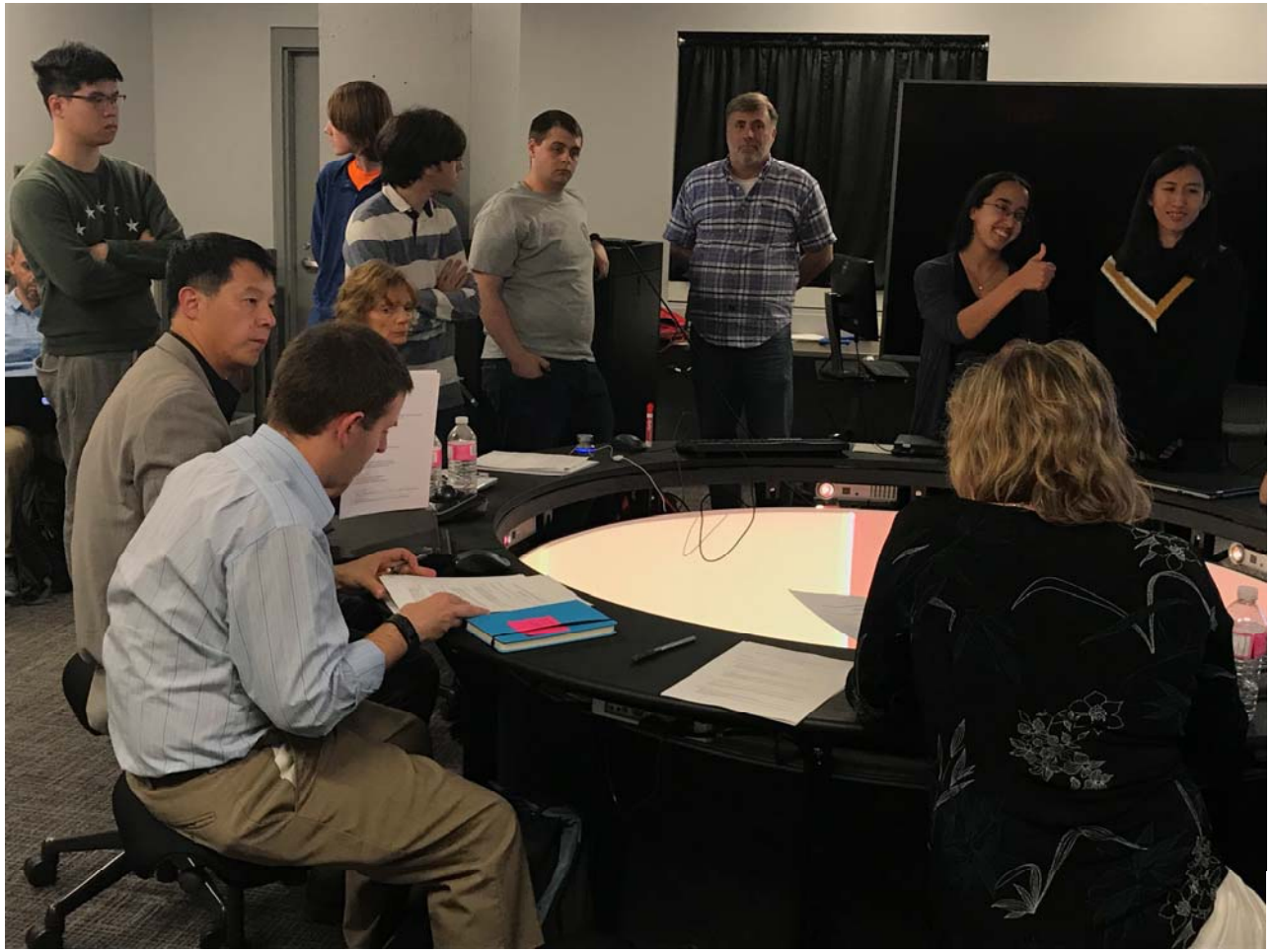
- 3 day Analytics ”Boot camp” offered January 2018
  - 52 participants (mostly SoE and SoS)
  - 7 faculty, 10 pdoc/staff, 35 graduate students
  - No cost to participants
- Exploring a slightly less intense version to offer “on the road” in FY19

Collaboration: The Rensselaer Campfire (IDEA)





Team Collaboration



Data INCITE Lab: Learning by doing

Innovative pipeline for creating next generation of agile data scientist and data users

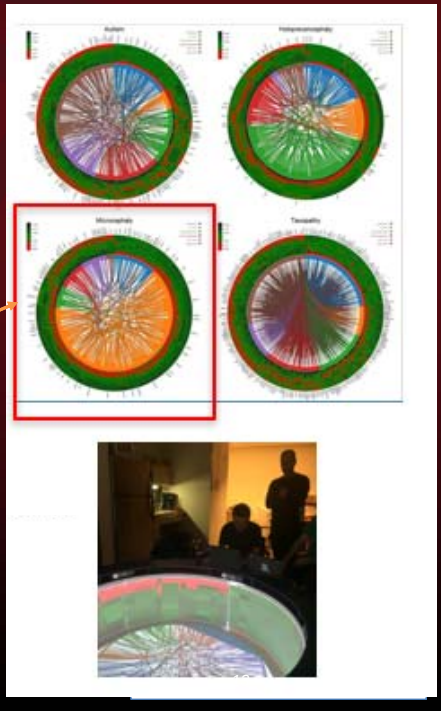
- Novel low-barrier course "*on ramps*"
- Partners with healthcare, industry and institutions for research projects
- Leads to student internships/coops/careers

About 200 students have done INCITE projects to date.

K. Bennett, RPI

Data INCITE Creates Impactful Research

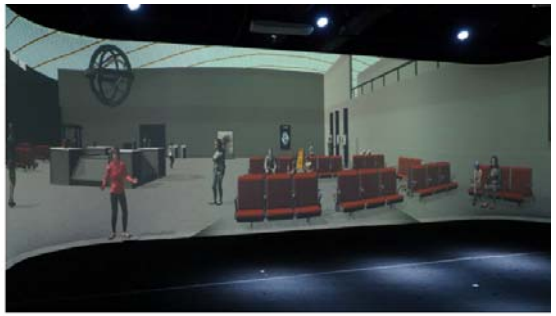
- Data INCITE undergraduate researchers partnered with Neural Stem Cell Institute to understand RNA-Seq data from “brain in a dish” model
- Became Rensselaer Tool for Identifying Corticogenesis (Brain Development) windows of susceptibility to disease
- Zika-virus induced “microcephaly” in infants has window of susceptibility in first 30 days of development
- Students developed **R to CAMPFIRE** workflow

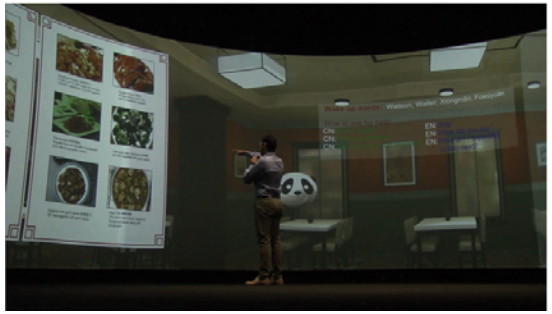


Rensselaer

Using Data Science (and AI) to teach other topics

Cognitive and Immersive Classroom – The Mandarin Project





Cognitive and Immersive Systems Laboratory at EMPAC

Conclusions

- Capacity Building in Data Science requires
  - Teaching the Skills
  - Understanding the Technologies
  - Developing the Science
  - Practice, Practice, Practice