MATHS 1004 Mathematics for Data Science I

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Data science

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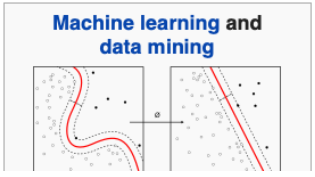
Not to be confused with information science.

Data science is a multi-disciplinary field that uses scientific methods, processes, algorithms and systems to extract knowledge and insights from structured and unstructured data.[1][2] Data science is the same concept as data mining and big data: "use the most powerful hardware, the most powerful programming systems, and the most efficient algorithms to solve problems".[3]

Data science is a "concept to unify statistics, data analysis, machine learning and their related methods" in order to "understand and analyze actual phenomena" with data.[4] It employs techniques and theories drawn from many fields within the context of mathematics, statistics, computer science, and information science. Turing award winner Jim Gray imagined data science as a "fourth paradigm" of science (empirical, theoretical, computational and now data-driven) and asserted that "everything about science is changing because of the impact of information technology" and the data deluge.[5][6]



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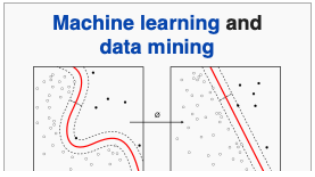

Harvard Business Review

DATA

Data Scientist: The Sexiest Job of the 21st Century

by Thomas H. Davenport and D.J. Patil

FROM THE OCTOBER 2012 ISSUE

Big Data Borat
@BigDataBorat

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Data Science is statistics on a Mac.

11:02 PM - 27 Aug 2013

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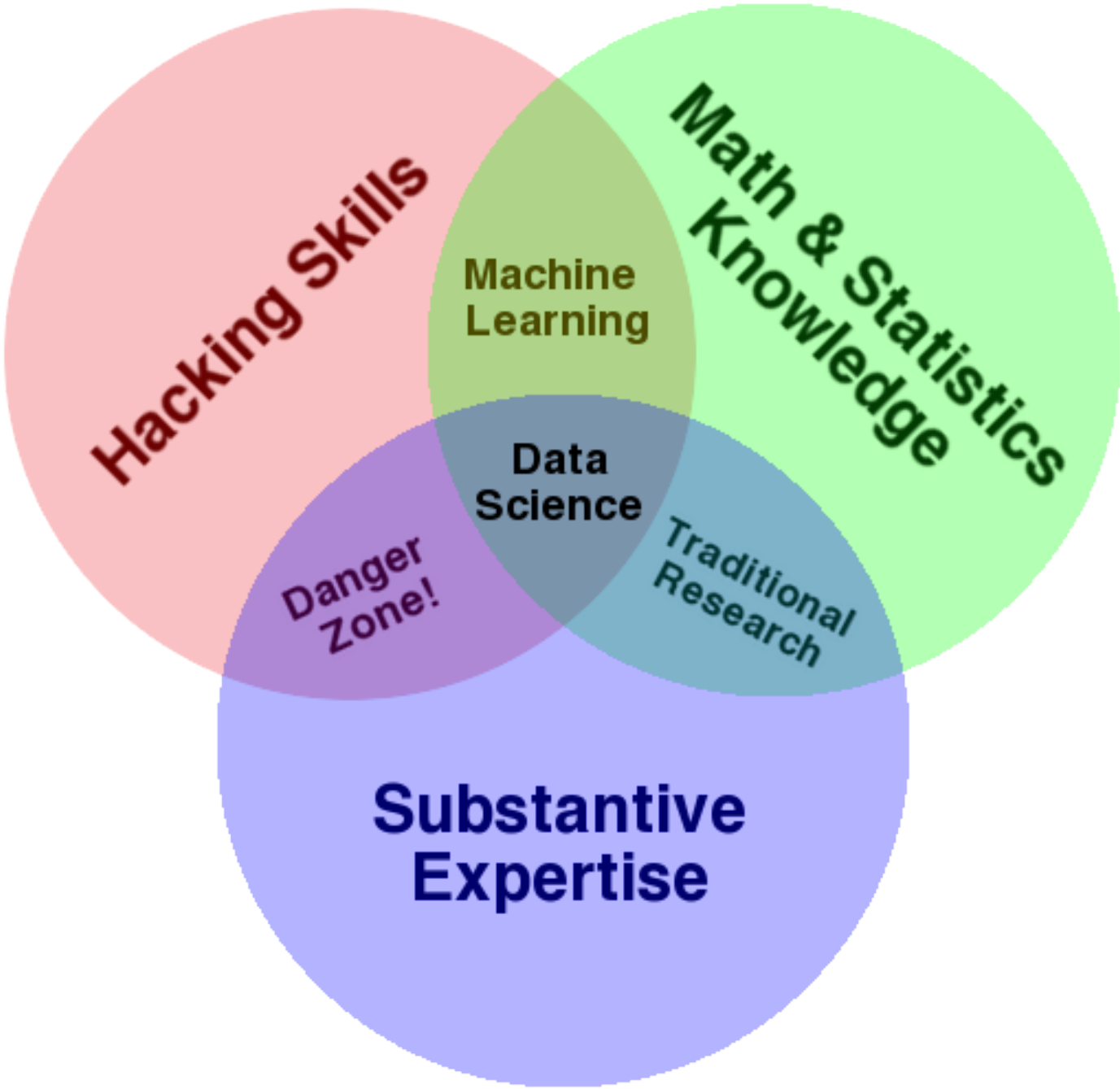
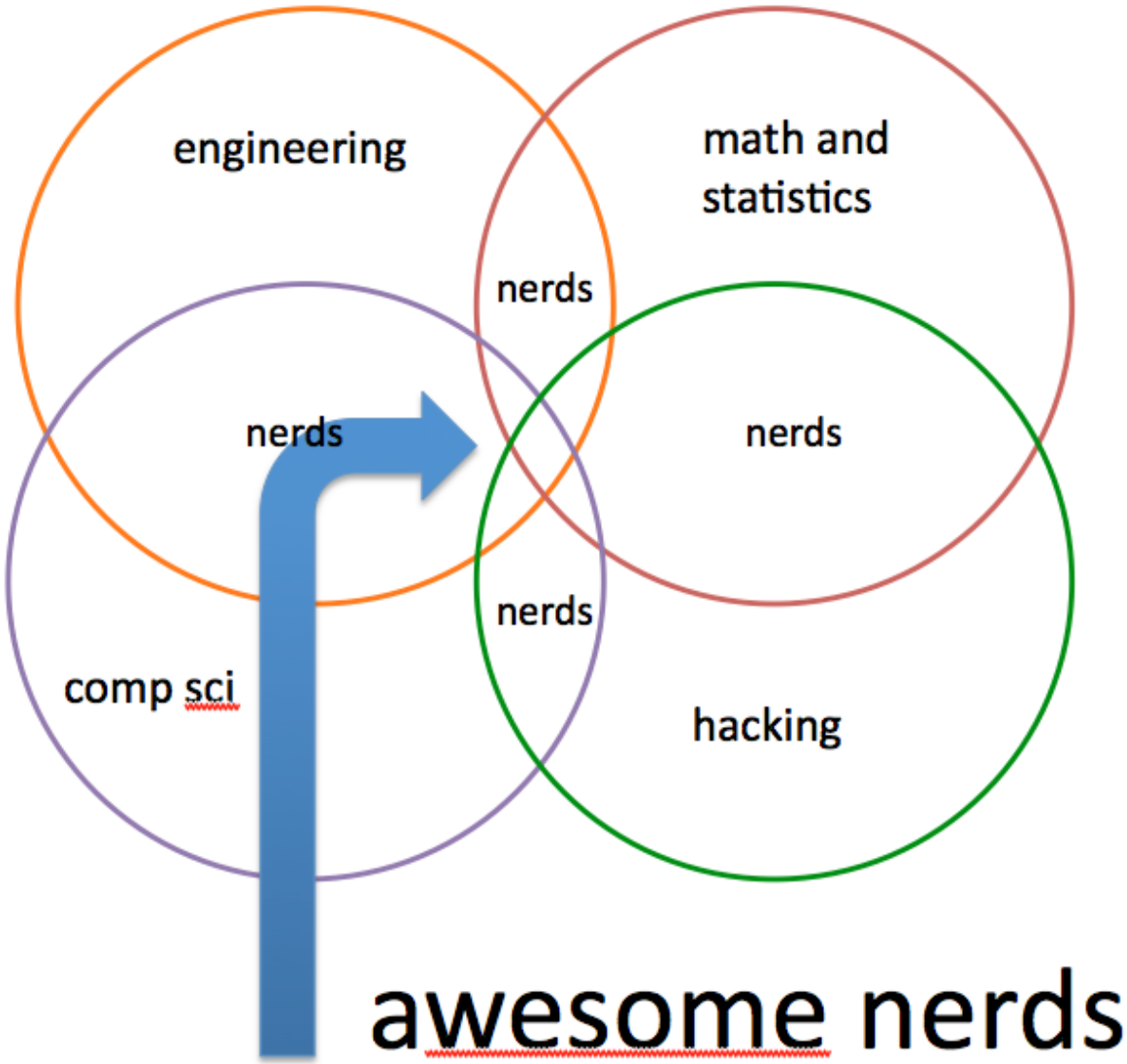
20 611 335


Hacking Skills
Math & Statistics Knowledge
Substantive Expertise
Machine Learning
Data Science
Danger Zone!
Traditional Research

Drew Conway

Data scientists?



Hilary Mason

This course

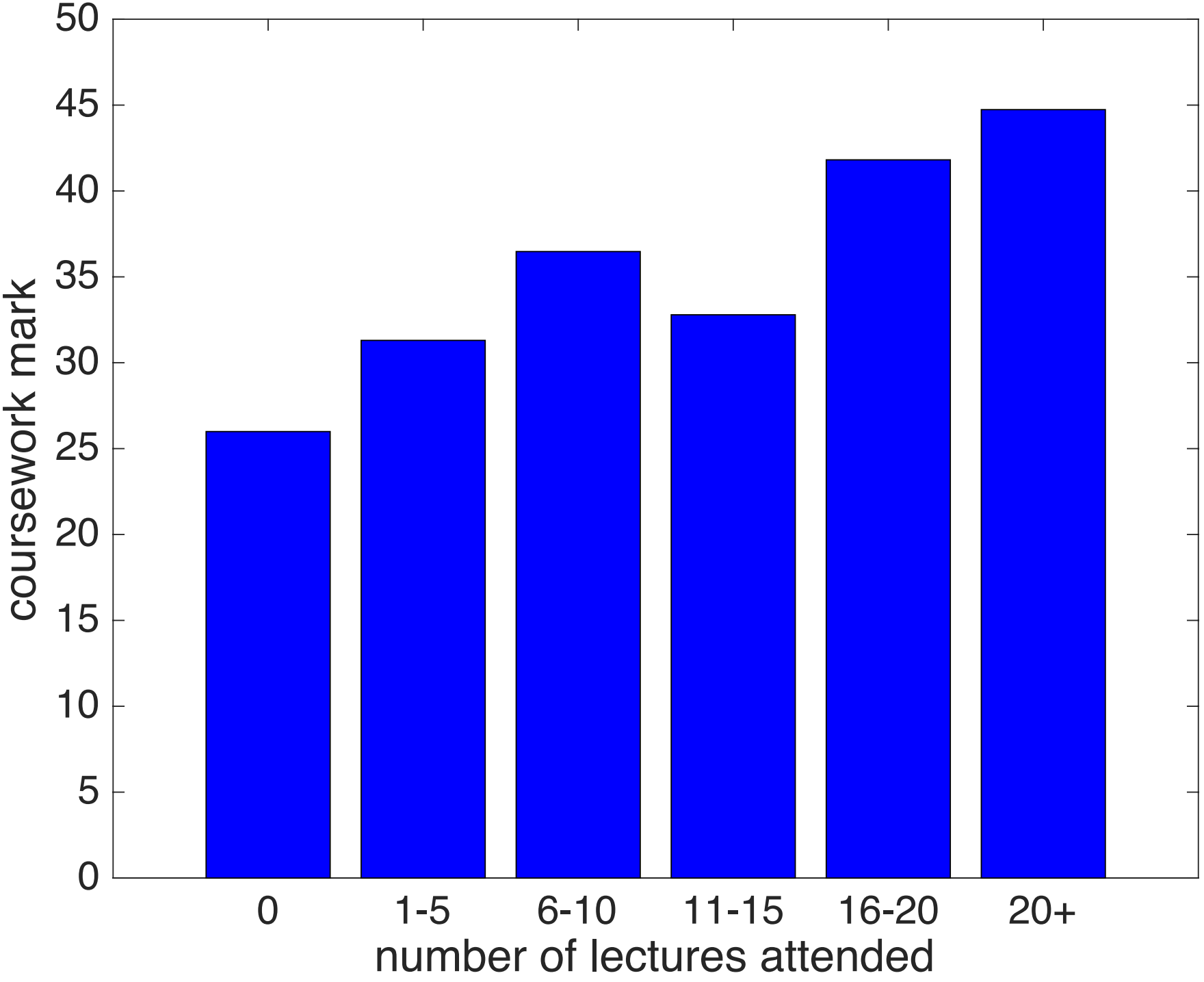
- Focuses on "Math & Statistics Knowledge"
- Introduces "Hacking" (in Python)
- Is motivated by "Substantive Expertise"

Course outline

1. Fundamentals
   - Notation
   - Functions
   - Approximation
2. Series
   - Summation
   - Taylor series
3. Linear algebra
   - Representing big, complex, data
   - Systems of equations
   - Dimension reduction
4. Probability
   - Discrete random variables
   - Continuous random variables & integration
5. Optimisation

Course structure

- 4 classes per week (3 lectures + 1 problem-solving)
  - Please be my audience!
- 6 computer labs (odd weeks)
  - Introduction to Python
- 6 tutorials (even weeks)
  - Best way to master the material for the exam
  - Whiteboard tutorials
  - Marks for (active) participation
  - Feedback on assignments


50
45
40
35
30
25
20
15
10
5
0
coursework mark
0
1-5
6-10
11-15
16-20
20+
number of lectures attended

Computer labs

Echo360 Question: Which programming languages are you familiar with?

- C/C++
- Java
- Julia
- Matlab
- Python
- R

Course assessment

- 5%: Lab & Tutorial participation
- 25%: Assignments (5 assignments, 5% each)
- 70%: Final exam

Assignments

- Due **Tuesdays 11am, odd weeks** (starting week 3)
- Submit via Canvas, **PDF** only
- Lateness/extension policy:
  - Up to 24 hrs late: 40% lateness tax
  - More than 24 hrs late: assignment can't be submitted. Apply for an exemption instead (with documentation)
- Assignments to be returned by next tutorial