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Introduction to Data Analytics - Course Outline

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Data Analytics ITWS-4600/ITWS-6600/CSCI-4600 BCBP- 4600/ MGM-4600/MGMT-6600
Group 1 Module 1, January 13th, 2026

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Rensselaer Polytechnic Institute



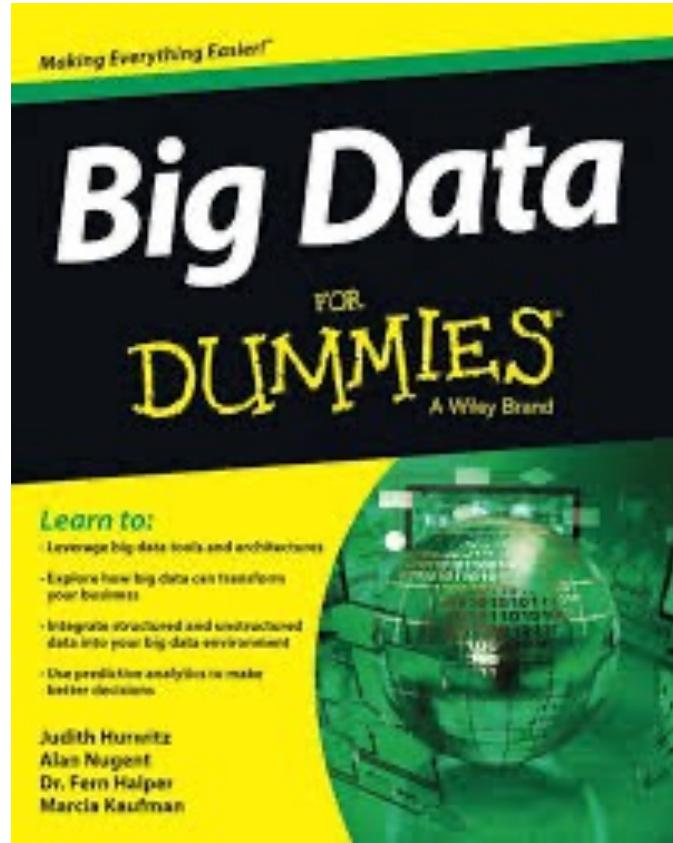
Admin information

- Class: ITWS-4600/ 6600/CSCI-4600/MGMT 4600/6600/BCBP 4600
- Hours:
 - Section 02: 10:00am ET - 11:50am ET on Tues/Fri – Lally 102
 - Section 01: 02:00pm ET - 03:50pm ET on Tues/Fri – Lally 104
- Instructor: Ahmed Eleish
- Instructor contact: eleisa2@rpi.edu
- Instructor office hours: Thursday from 02:00 PM - 4:00 PM ET or by appointment/email
- Instructor office location: Lally 315
- TA: Vitor Ferreira - fernav4@rpi.edu
- TA office hours: TBA
- TA office: TBA
- Web site: <https://tw.rpi.edu/classes/data-analytics-spring-2026>
- LMS (<http://lms.rpi.edu/>)



Contents

- Intro – about this course
 - Learning objectives
 - What is expected
 - What skills are needed
 - Outline of the course
- Definitions and why ‘analytics’ means more than ‘analysis’



Objectives

- Introduce students to relevant methods to recognize and apply quantitative algorithms, techniques and interpretation.
- To develop students' strategic thinking skills, combined with a solid technical foundation in data and model-driven decision-making.
- Develop ability to apply critical and analytical methods to formulate and solve science, engineering, medical, and business problems.



Objectives

- Students will examine real-world examples to place data-mining techniques in context, to develop data-analytic thinking, and to illustrate that proper application is as much an art as it is a science.
- By the end of the course, students can effectively communicate analytic findings to non-specialists.
- [6600 level] Students must develop and demonstrate a working knowledge of decision making under uncertainty, be able to optimize models that incorporate parameters.



4600 versus 6600

- 6600 students are assessed at:
 - Higher level of demonstration
 - Additional questions or tasks in assignments
- 4400 students are welcome to complete these higher requirements for extra credit



Assessment and Assignments

- Via written assignments with specific percentage of grade allocation provided with each assignment.
- Via individual oral presentations with specific percentage of grade allocation provided.
- Via participation and attendance (5% of total, **start with 5% and lose % by not attending classes without notification**).
- Late submission policy: first time with valid reason – no penalty, otherwise 20% of score deducted each late day. Talk to me EARLY if you are having schedule problems in completing assignments.



Assessment and Assignments

- Readings are given when needed to support key topics or to complete assignments.
- No reporting is required on the readings unless there are questions.
- You will mostly perform individual work, but you are encouraged to work with others in the lab sessions



Current assignment structure (no final exam)

- Assignment 1: Review of a DA Case Study. - 5% (written)
- Assignment 2: Distributions, Linear Models, Classification & Clustering – 10% (written + figures)
- Assignment 3: Term project proposal - 5% (oral/written)
- Assignment 4: Term project - 30% (25% written, 5% presentation - oral)
- Assignment 5: Preliminary and Statistical Analysis - 15% (written + figures)
- Assignment 6: Patterns, trends, relations: model development and evaluation - 15% (written + figures)
- Labs - 15%
- 5% participation (attendance)



Project options (examples)

- Social networks
- Financial
- Social-economic, marketing
- Geo/ space science data
- Network/ security data
- Linked data
- Movie databases
- Transportation
- Competitions (Web and local)*
- Research Projects*

Research Projects & Competitions* : Need the Instructor's approval for the datasets



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Academic Integrity

- Student-teacher relationships are built on trust. For example, students must trust that teachers have made appropriate decisions about the structure and content of the courses they teach, and teachers must trust that the assignments that students turn in are their own. Acts, which violate this trust, undermine the educational process. The Rensselaer Handbook of Student Rights and Responsibilities defines various forms of Academic Dishonesty and you should make yourself familiar with these. In this class, all assignments that are turned in for a grade must represent the student's own work. In cases where help was received, or teamwork was allowed, a notation on the assignment should indicate your collaboration.
- Submission of any assignment that is in violation of this policy will result in a penalty. If found in violation of the academic dishonesty policy, students may be subject to two types of penalties. The instructor administers an academic (grade) penalty of full **loss of grade** for the work in violation, and the student may also enter the Institute judicial process and be subject to such additional sanctions as: **warning, probation, suspension, expulsion**, and alternative actions as defined in the current Handbook of Student Rights and Responsibilities.
- Second violation will result in **failure** of the course.
- **If you have any question concerning this policy before submitting an assignment, please ask for clarification.**



What is expected

- Attend class, complete assignments and labs.
- Ask questions, offer answers in class.
- Work individually on assignments and projects.
- Work in a group on labs, learn from each other, help each other especially with the software.



Skills needed

- Basic knowledge of data structures, computer programming
- Literacy with computers and applications that can handle the data we will use
- Ability to access internet, servers and retrieve/ acquire data, **install/ configure software**
- **Pick up R programming**, terminology and syntax, and some refinement
- Presentation of proposal, project and assignment results



Current Syllabus/Schedule

- Web site: <https://tw.rpi.edu/classes/data-analytics-spring-2026>
- Note: in general lectures are on Tuesdays, labs on Fridays



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Questions so far?



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Peter Arthur Fox, Ph.D.
1959 - 2021

Introductions

- Who you are (name/ year/ major)
- Why you are here
- What you expect to learn
- Your interests/ hobbies



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What is data analytics?

- “*Data analytics* is the process of collecting, transforming, and organizing data in order to draw conclusions, make predictions, and drive informed decision-making.”
(Coursera – 2025)
- “*Data analytics* is how organizations turn raw data into business value. By analyzing large datasets, organizations can uncover patterns that yield insights, inform decision-making, and lead to better business outcomes.” (SAP – 2024)
- “*Data analytics* can optimize business performance by measuring and weighing raw data to gain information and draw conclusions from it.” (Investopedia - 2025)

<https://www.sap.com/resources/what-is-data-analytics> ;

<https://www.coursera.org/articles/data-analytics> ;

<https://www.sap.com/resources/what-is-data-analytics>



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What is data analytics?

- *“Data analytics converts raw data into actionable insights. It includes a range of tools, technologies, and processes used to find trends and solve problems using data. Data analytics can shape business processes, improve decision-making, and foster business growth.” (AWS – 2025)*
- *“Data analytics is the process of collecting information for the purpose of studying it to generate insights. High-level analysis is primarily performed by data scientists, but the latest data analytics platforms have tools, such as queries based on natural language processing and automated insights, that allow business users to dig into datasets.” (Oracle – 2025)*
- *“Data analytics is the process of analyzing raw data to find trends and answer questions. It has a broad scope across the field. This process includes many different techniques and goals that can shift from industry to industry.” (MastersInDataScience.org - 2025)*

<https://aws.amazon.com/what-is/data-analytics/> ;

<https://www.oracle.com/analytics/data-analytics/> ;

<https://www.mastersindatascience.org/learning/what-is-data-analytics/>



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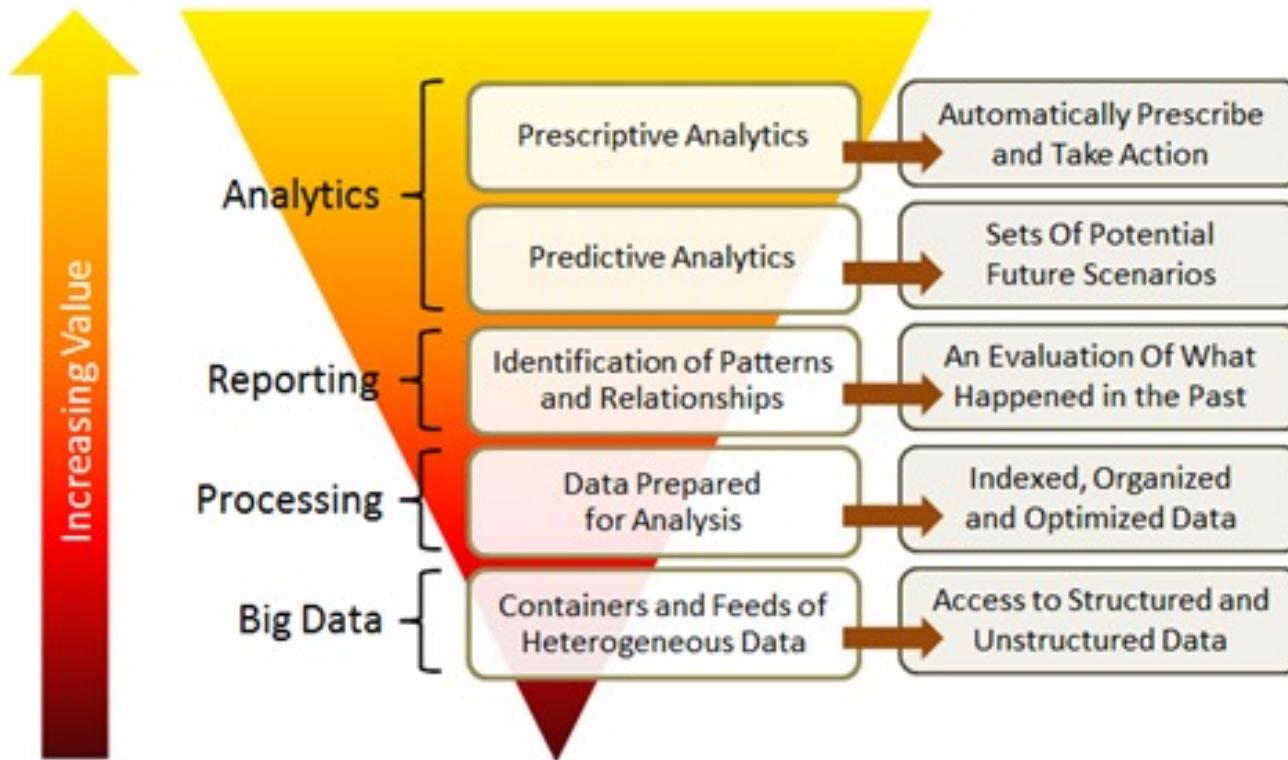


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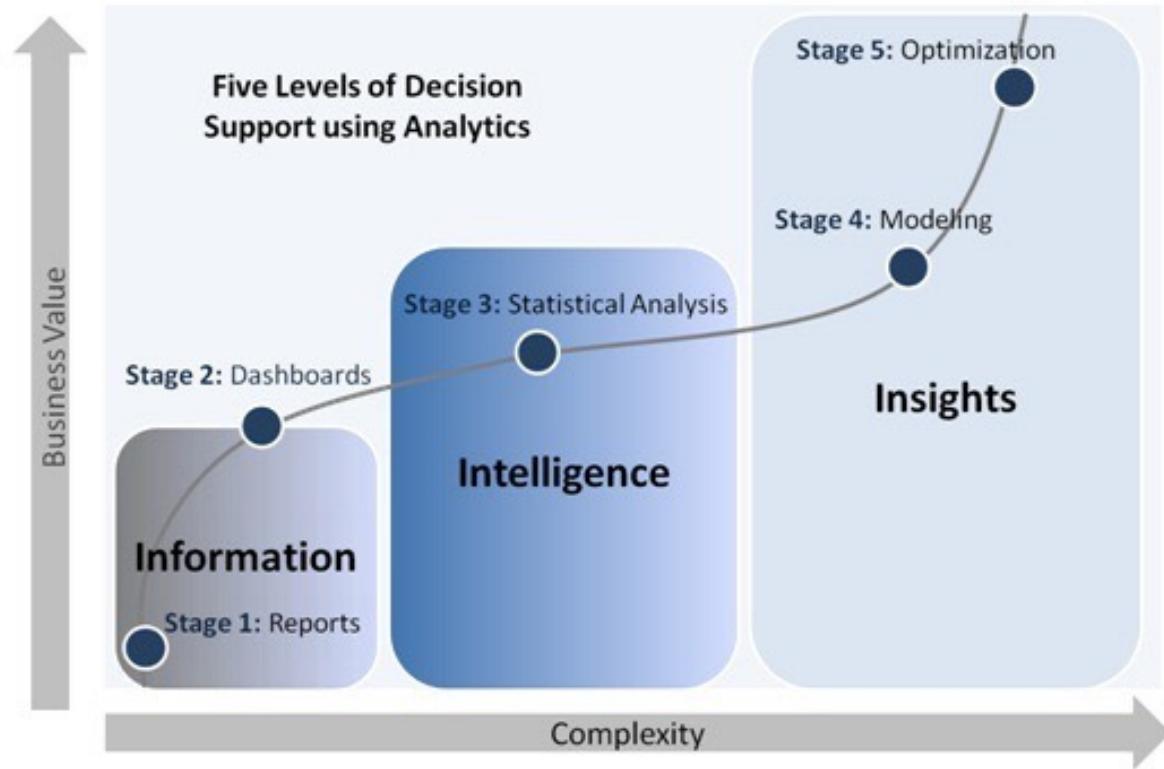
- *Data Analytics is an umbrella term often used to refer to a several activities involved in the life-cycle of data, including discovery, acquisition, summarization, transformation, analysis, modeling, and knowledge generation. (RPI Data Analytics – 2026)*
- * In this course we will focus on post acquisition activities.



A perspective on analytics



Another perspective on analytics



A view from IBM ...

- “Anyone who wants to learn something about data analytics should take a road trip. Myriad real-time decisions must be made based on analysis of static information as well as ever-changing conditions. Data about traffic, weather, road construction, fuel, time, current location and available funds are just a few of the factors.”
- This information and much more are needed to answer questions like:
 - If I skip this gas station, will I run out of gas before the next one?
 - Is it worth driving 50 miles out of the way to see the Corn Palace? How late will that side trip make us?
 - Can I make it to Billings, Montana., by sunset or should I look for a place to stop?



Common assumptions between different perspectives

- People make decisions every day that are increasingly using resources/ services (that require data) to assist or decide for them.
- Knowledge can translate to “power”:
 - Or: accurate/ reliable knowledge is actionable.
- Knowledge is generated from the analysis and modeling of data.
- Data are often acquired from multiple sources requiring well-planned transformation/ integration.
- Extracting value from data requires a methodological, systematic approach.

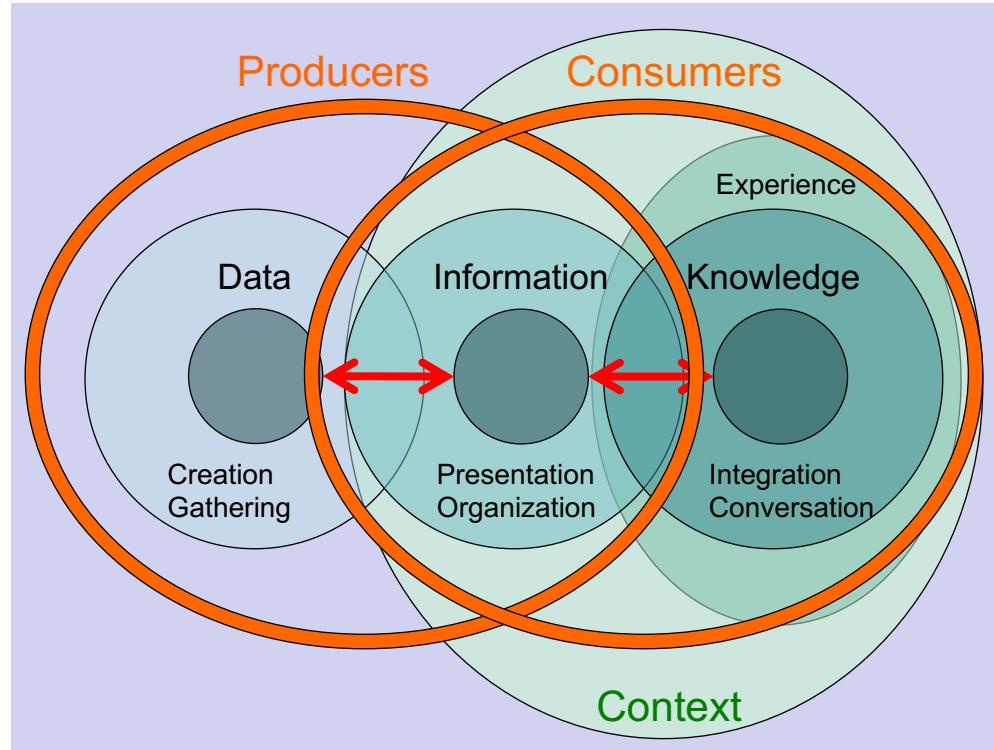


Definitions (at least for this course)

- Data - are encodings that represent the qualitative or quantitative attributes of a variable or set of variables.
- Data (plural of "datum", which is seldom used) - are typically the results of measurements, computations, or observations and can be the basis of graphs, images of a set of variables.
- Data - are *often* viewed as the lowest level of abstraction from which information and knowledge are derived.
- Model = formula/equation that approximates the phenomenon being studied.



Data Lifecycle



And then there is **was** Big Data

5 + 1 V's: volume, variety, veracity, velocity, value + variability

https://en.wikipedia.org/wiki/Big_data

- Big data as a term is meant to have a positive connotation in common use, whereas the scale represents challenges, the benefits are guaranteed, i.e. more data = “more good” ..
- Critiques range from whether the terminology is appropriately descriptive and meaningful to the responses from different sectors of society (e.g. academia, industry and government) to the phenomena of increasing availability of data.



Data Analysis

- Summary statistics, parametric statistics / probability distributions.
- Going from preliminary to exploratory to predictive analysis.
- Visualizations – plots, graphs and more.
- Software packages / environments:
 - Gnu R
 - Rstudio
 - Extensive libraries
 - <Jupyter Notebook/ Lab>



What are "statistics"?

- The term "statistics" has **two common meanings**, which we want to clearly separate: **descriptive** and **inferential** statistics.
- But to understand the difference between descriptive and inferential statistics, we must first be clear on the difference between **populations** and **samples**.
- Coming up next lecture.



Summary

- We'll work our way through the stages of analytics.
- We'll use both laptop installed software for analytics to give you practical experience.
- We'll cover algorithms, parameter choices, models, results, visualizations, interpretation, and the software.

*** This is a fast-paced course ***

Labs + assignments + individual project, keep up, reach out if you're behind..



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Reference Material

- Will be posted to course website if available.

Files

- We will use Box, please make sure your accounts are set up
- Links will be shared in slides



Assignment 1



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Next class: Tuesday Jan 16th – quick refresher
on statistics and intro to labs..



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Head start for lab - R

- <http://lib.stat.cmu.edu/R/CRAN/> - install this first
- <http://cran.r-project.org/doc/manuals/>
- <http://cran.r-project.org/doc/manuals/R-lang.html>
- R Studio
(<https://www.rstudio.com/products/rstudio/>)
(desktop version)



Thanks!

* See you Friday! (work on the assignment!)



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