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Biostatistics BT2023

Lecture 1 : Introduction

Himanshu Joshi 04 August 2023

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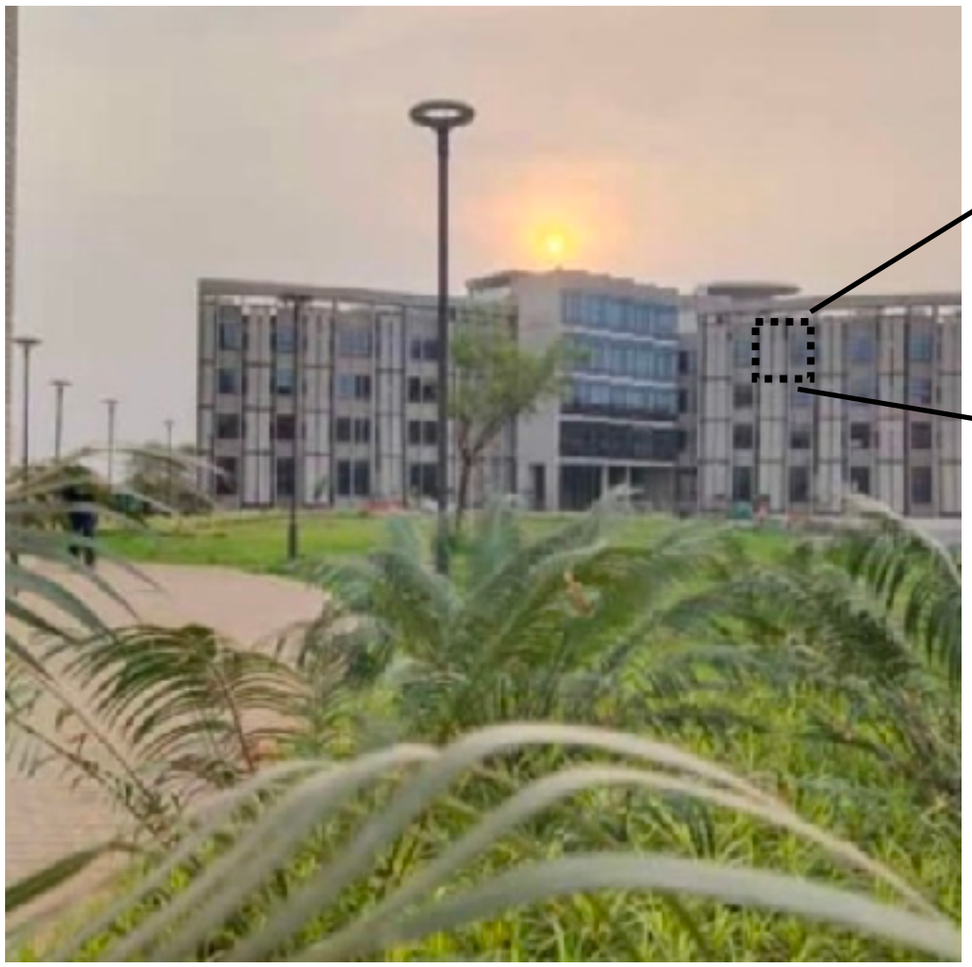
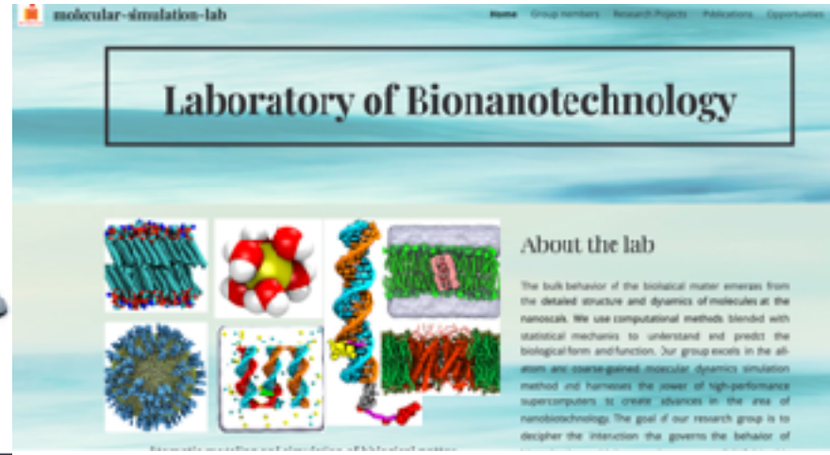
About the instructor

Himanshu Joshi

Laboratory of computational Bionanotechnology

Department of Biotechnology





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About students

- Name and introduction
- Background
- Future Interest

Objective of the course

- The course is designed to introduce the basic concept of data or statistics and their application into the related areas of biosciences.

- Students will be able to effectively present their data and findings in different situations, achieve greater precision with available recourses.

- In the age of information, statistics has become an integral part of research, particularly it has profound applications in human health and disease control.

- Overall this course will help students to understand the importance of data and preparing them for scientific research and presentation.

Objective of the course

- Descriptive statistics
- DATA visualization
- Confidence intervals
- Hypothesis tests
- Regression models
- ANOVA models

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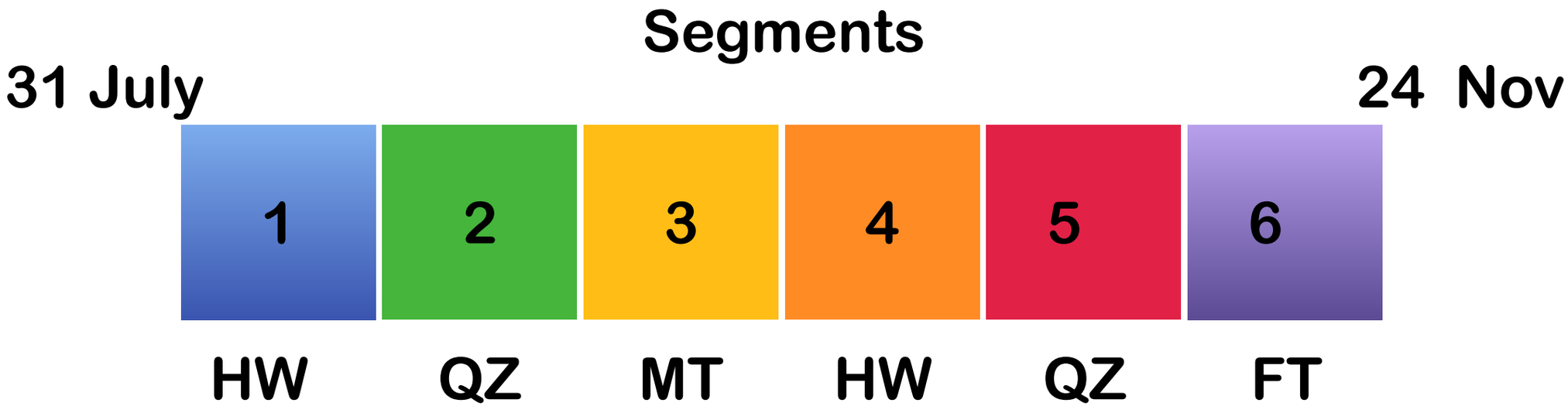
Course contents

- Introduction
- Plotting and data visualization
- Measures of central tendencies
- Dispersion and shape of distributions
- Correlation and Regression
- Interpolation and extrapolations
- Ψ^2 test and goodness of a fit
- Non-linear data fitting
- Introduction to python and R programming
- Probability, Conditional probability and Baye's theorem
- Random variables
- Probability density function
- Expectation, variance and co-variance
- Binomial, Poisson and Gaussian distributions
- Data distributions and central limit theorem
- Confidence intervals and Test of hypothesis

Exam and evaluation



Homeworks/ Assignments/Reading project	20
2 quizzes one in each segment	20
1 midterm	30
1 final term exam	30
Total	**100**

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Reference Books

1. ***All of Statistics: A Concise Course in Statistical Inference***
by
Larry Wasserman

Springer Texts in Statistics

2. ***Introduction to Probability & Statistics***
by
Medenhall, Beaver and Beaver

Cengage Learning;

3. ***Introduction to Probability & Statistics for Engineers and Scientists***
by
Sheldon M. Ross
Elsevier

What is Biostatistics

When you can measure what you are speaking about, and express it in numbers, you know something about it.

When you cannot express it in numbers, your knowledge is of a meager and unsatisfactory kind.

Kelvin

Statistics (essentially plural) is science of figures. It deals with collections, classification, interpretations of numerical facts or data.

Application of statistics to achieve precision in the fields of biological sciences such as human biology, public health and medicine etc.

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Statistics vs Biostatistics

Statistics is a broader approach of collecting, analyzing, interpreting, and presenting data. Whereas biostatistics uses statistical methods to answer questions pertaining to topics in biology.

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Type of statistics

Descriptive statistics

visible characteristics of a dataset, data presentation, visualization

Inferential statistics

focus on making predictions or generalizations about a larger dataset, based on a sample of those data

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Why Biostatistics is important

- In science, it is imperative to translate an observation into numbers or figures. People have created various units and your statements only make sense when you talk about numbers

- Once you perform an experiment then you can make a statement about the particular phenomenon, the output of your experiment is data or statistics.

- In public health, the data can help to identify the best way to deploy resources to treat populations.

Data collection methods

- Experiments
- Records
- Survey

Quantitative data (Numerical variable)

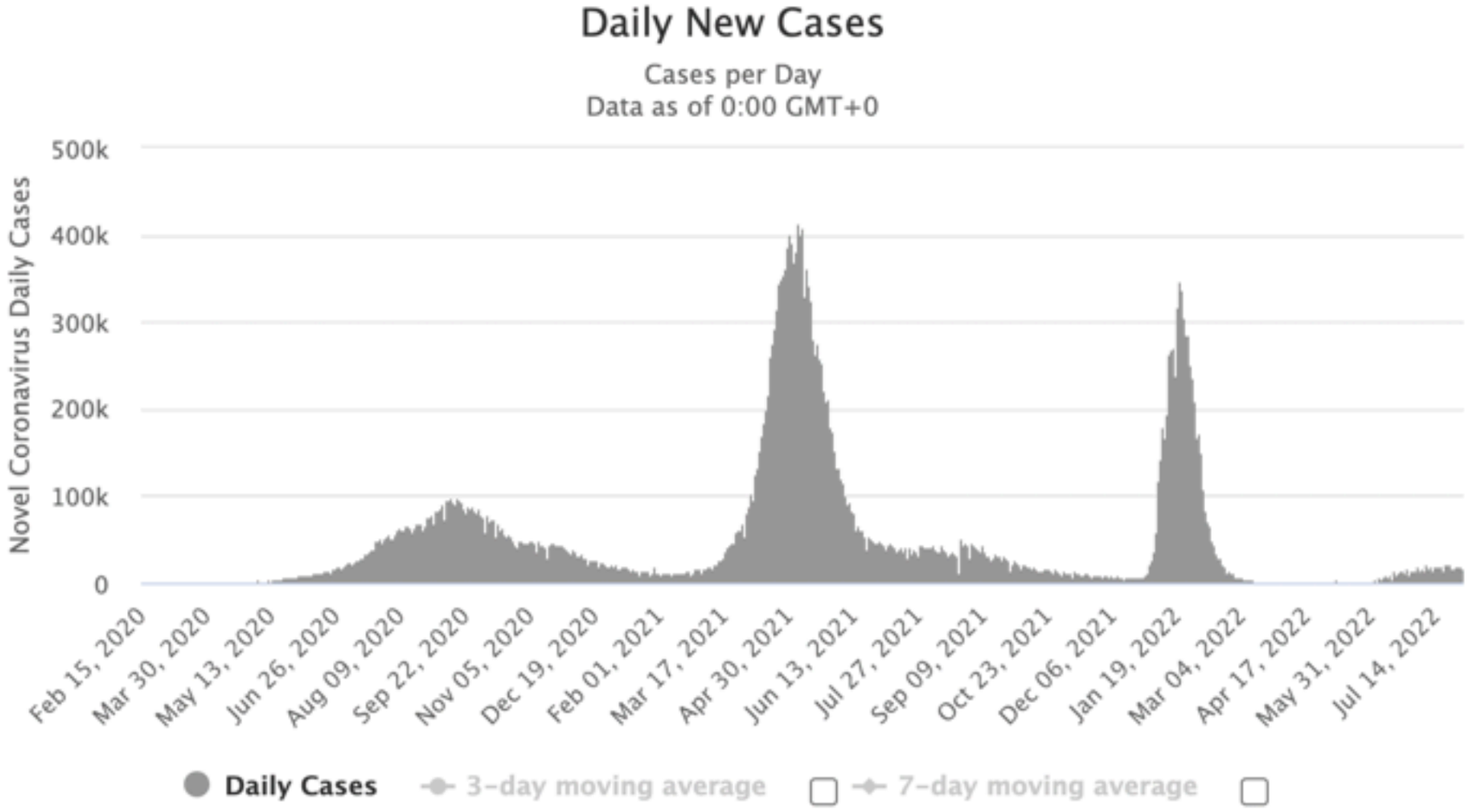
Qualitative data (categorical variable**)**

Why Biostatistics is important

The analysis of the data can help in making an informed decision

For example; *what will be the probability of a person coming from a particular country will have the infected disease, should we close the flights from a particular country ?*

Accessing the performance of the drug in the clinical trials and should it be given the clearance



Source
www.worldometers.info/

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What is Truth

- **Belief:** A statement that is not scientifically provable in the same way as facts, laws, hypotheses or theories. Scientifically disproven beliefs can still be held to be true.
- **Hypothesis:** A tentative statement such as if **A** happens then **B** must happen that can be tested by direct experiment or observation. A proven hypothesis can be expressed as a law or a theory. A disproven hypothesis can sometimes be re-tested and found correct as measurements improve.
- **Conjectures:** An idea, hypothesis is a conjecture which can be tested.
- **Fact:** A basic statement established by experiment or observation. All facts are true under specific conditions. Some facts may be false when re-tested with better instruments.
- **Law:** A logical relationship between two or more things that is based on a variet y of facts and proven hypothesis. It is often a mathematical statement of how two or more quantities relate to each other.
- **Theory:** An explanation for why certain laws and facts exist that can be tested to determine its accuracy.

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For every action, there is an equal and opposite reaction.
F = ma
Water freezes at 32 F
The Earth is a sphere.
The universe is expanding.
Humans were created separately from all other life on Earth.
Humans and gorillas evolved from a common ancestor species.
Light is an electromagnetic phenomenon described by Maxwell's Laws
Matter is comprised of atoms.
- The sun will die in 7.5 billion years.
- Earth's magnetic field is generated by a conducting fluid in its core.
- Sunspots are colder than the surface of the Sun.
- There are such things as ghosts.
· The solar system formed from a primordial disk of gas and asteroidal material.
· Matter can be converted into energy.
- Energy can be converted into matter.
- The positions of the planets can cause humans to act in specific ways.
· Momentum is the product of a bodies mass and its velocity.
- The core of the Sun has a temperature of 14.5 million Centigrade.
- We will never know how life started on Earth.
- The Milky Way is a spiral-type galaxy.
- Black holes exist.
- The sun will rise tomorrow morning.
- The Earth is older than 10,000 years.
- Genetic mutations cause organisms to change over time.
- Primitive human-like creatures existed 2 million years ago.
- If I jump out a window I will die.
- The universe was created at the Big Bang.
- The first generations of stars appeared about 100 million years after the Big Bang.
- Space exists in 10-dimensions not just 3.
- Some numbers are more lucky than others.

Source
https://www.nasa.gov

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Next Class

2:30 PM Tuesday, 8 August 2023

Plotting and data visualization

Line plot, Histograms, Bar charts, Pie plot, Scatter plot etc

Python programming !!