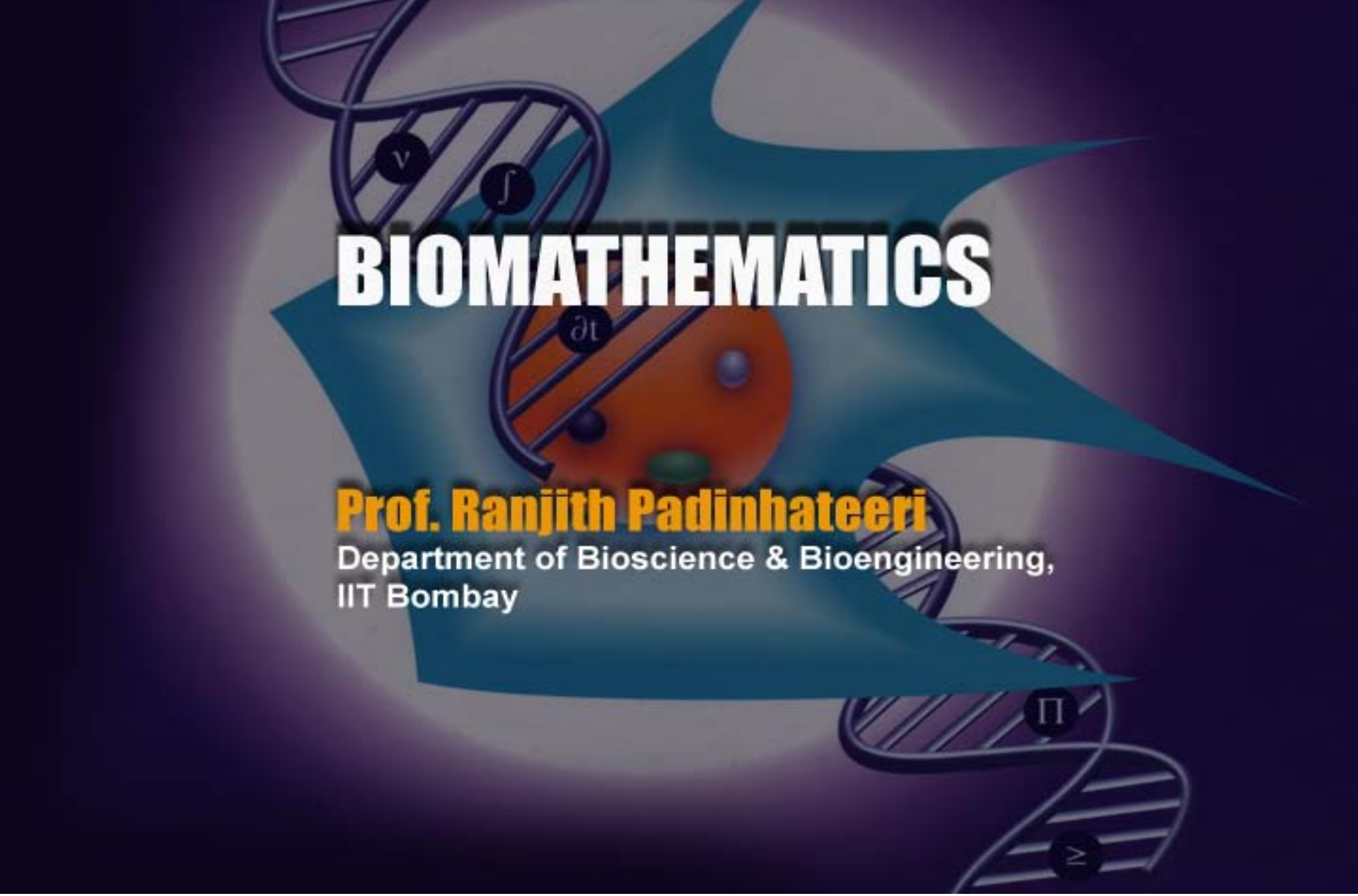
BIOMATHEMATICS
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Lecture 22

Statistics

Probability distribution

Experiment: measure height

Measure height of boys in your class.

What do you get ?

Height of boys in class 12

150 cm, 171 cm, 165 cm, 140 cm,

161 cm, 155 cm, 157 cm, 162 cm

131 cm, 145 cm, 180 cm, 150 cm,

155 cm, 151 cm, 159 cm, 161 cm

Height of boys in class 12

150 cm, 171 cm, 165 cm, 140 cm,

161 cm, 155 cm, 157 cm, 162 cm

130 cm, 145 cm, 180 cm, 150 cm,

155 cm, 151 cm, 159 cm, 161 cm

How do we make sense of this data ?

We can find average and standard deviation

Is there any other way we can present this data so that it reveals much more useful information ?

We can find average and standard deviation

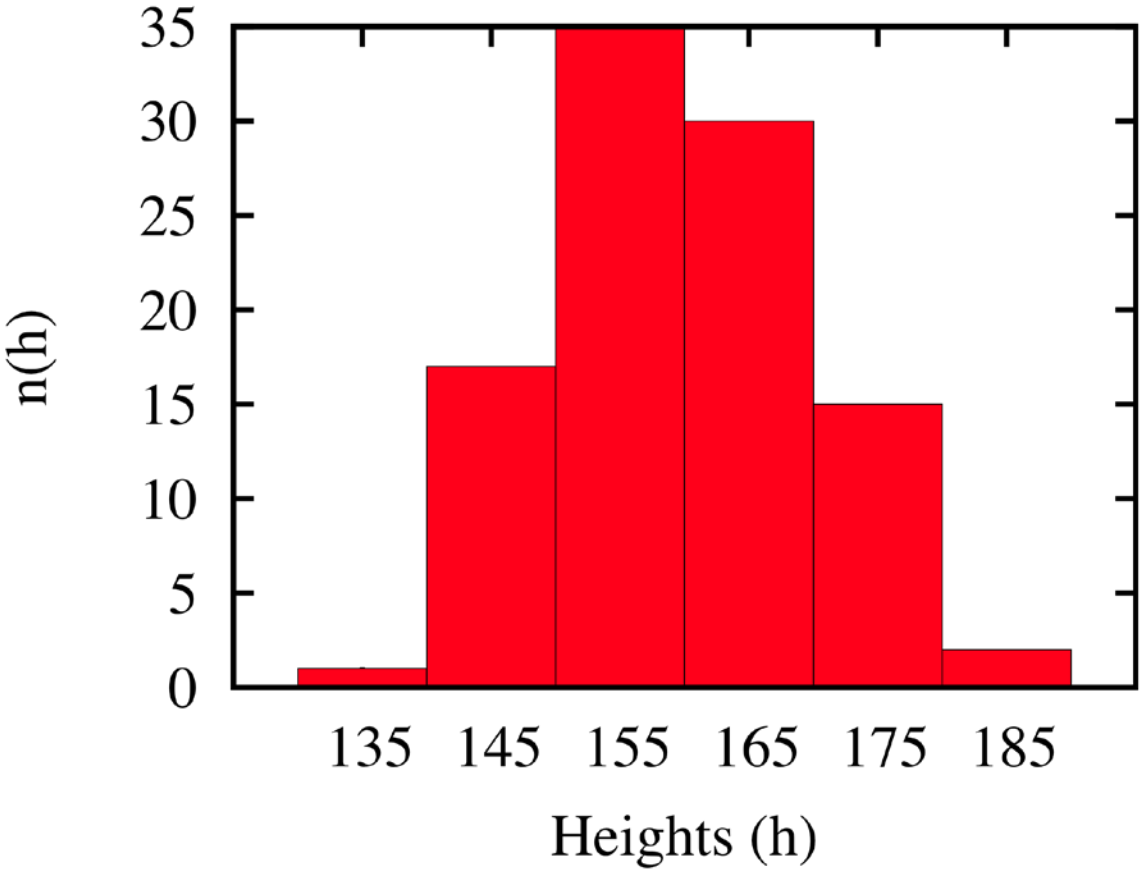
Is there any other way we can present this data so that it reveals much more useful information ?

Answer: distribution

Distribution of heights

Height range	Number of students having height in this range
130-140	1
140-150	17
150-160	35
160-170	30
170-180	15
180-190	2

Distribution of heights

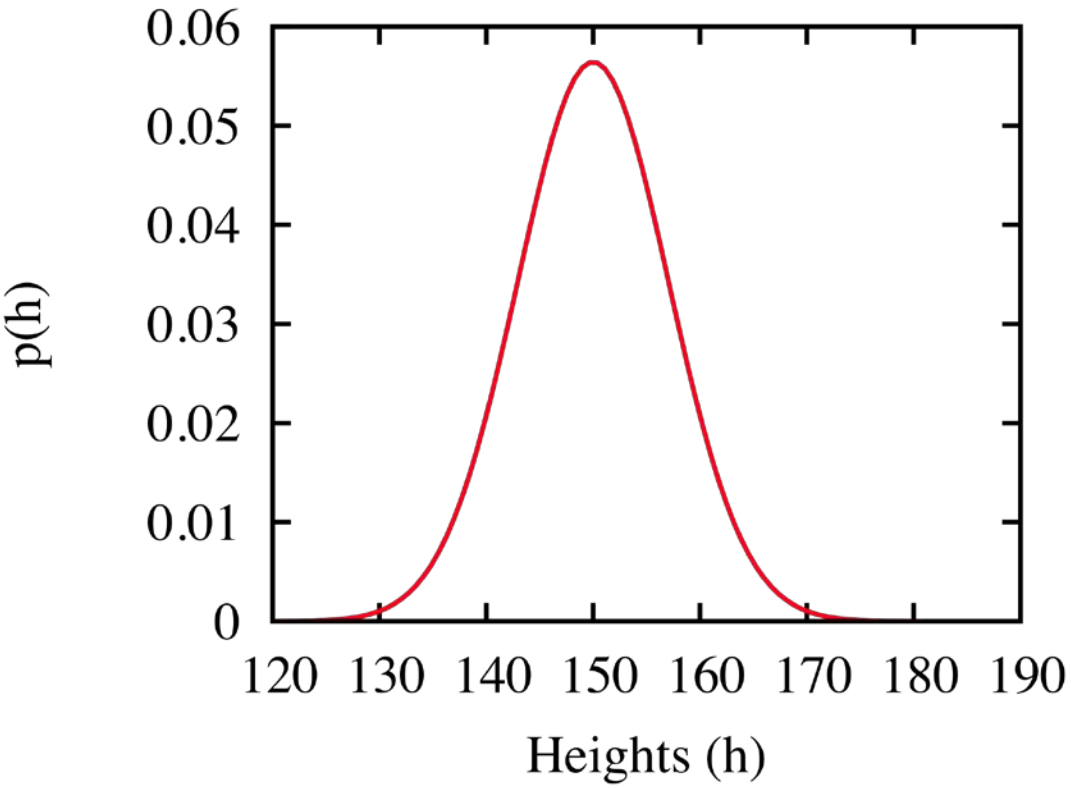


Make the range smaller to get a better description of the real data

$$N = \sum_i n_i$$

$$p(h) = \frac{n(h)}{N}$$

Probability distribution



$$\langle h \rangle = \sum_{i=1}^{m} h_i p(h_i)$$

$$\langle h^2 \rangle = \sum_{i=1}^{m} h_i^2 p(h_i)$$

Standard deviation

Standard deviation: $\sqrt{\langle h^2 \rangle - \langle h \rangle^2}$

Normal distribution

$$p(h) = A\exp\left[-B\left(h - \langle h \rangle\right)^2\right]$$

$$f(x) = \exp\left[-Bx^2\right]$$

Examples in Biology

End-to-end distance distribution of long DNA

Concentration of diffusing proteins

Amount of a particular gene expressed in cells