Physics 421 / PCSE 503

Lecture 5

→ visualizing data

→ fitting data.

1. numerical methods ← root
2. data analysis ←
3. simulation. ← projectile

$\boxed{\text{REAL LIFE}}$

Analyzing Data

↳ visualize

↳ search for outliers

↳ general trends
(obvious)

↳ correlations

$$y = f(x, y, z, t, u, v, w \ldots)$$

pandas → DataFrame()
↑
spreadsheet

Gaussian

$\sigma = 1$

$-3 \ldots +3$

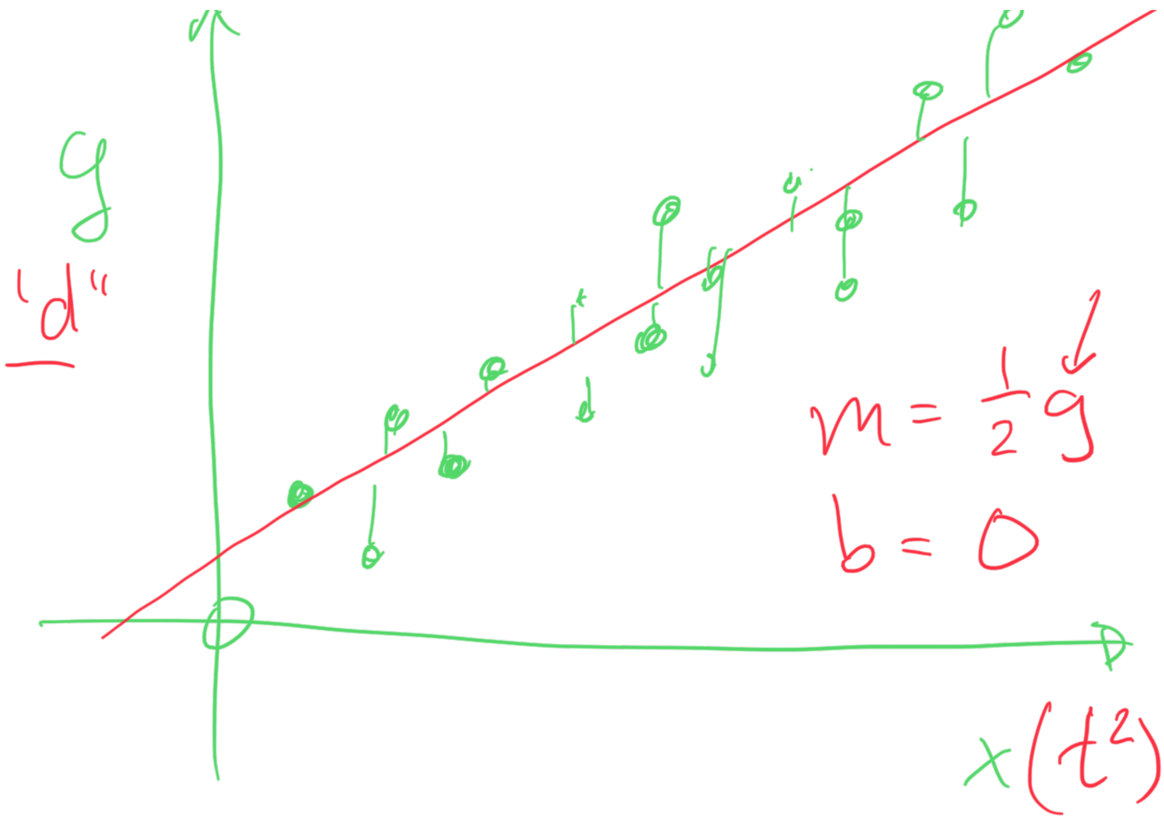
99.5%

Data Table

x	y	δy

$\boxed{\text{Linear Regression}}$

$d = \frac{1}{2} g t^2$



$m = \frac{1}{2} g$

$b = 0$

imagine 8

$y = \boxed{m}x + \boxed{b}$

Best fit

$m \pm \delta m$

$b \pm \delta b$

uncertainties in parameters of fit.

$$= 2(m \pm \delta m)$$

$\boxed{\text{Linear Regression}}$

$y_{fit} = ax + b$

$$\sum_{i=1}^{N} \frac{\left(y(x_i) - y_{fit}(x_i)\right)^2}{\delta y_i^2}$$

$$= \chi^2$$

$$\frac{\partial \chi^2}{\partial a} = 0 \qquad \frac{\partial \chi^2}{\partial b} = 0$$

$m = $ ______

$b = $ ______

Alcohol Sales
Tobacco Sales in UK

Is there a correlation?

How do we know for sure that NI pt. is an outlier?

OLS $y = mx + b$

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$$\nu_{TOTAL} = N - 1 = 10$$

$$\nu_{reg} = \# par - 1 = 1$$

model

ν_{error} (residuals) $= 10-1 = 9$

Intercept (b) $= 4.3512 \pm 1.607$

$m = 0.3019 \pm .439$

b) Uniform

$g = \frac{2h}{t^2}$

$$\delta g = \left| \frac{\partial g}{\partial h} \right| \delta h + \left| \frac{\partial g}{\partial t} \right| \delta t$$

$\frac{2}{t^2}$

$$\frac{4h}{t^3}$$

$$\boxed{\delta g = \frac{2}{t^2}\delta h + \frac{4h}{t^3}\delta t}$$

$h \pm \delta h$

$t \pm \delta t$ $\qquad g \pm \delta g$

c) Gaussian.

$$\boxed{(\delta g)^2 = \left(\frac{\partial g}{\partial h}\right)^2 (\delta h)^2 + \left(\frac{\partial g}{\partial t}\right)^2 (\delta t)^2}$$

$$e^{-\frac{(x-x_0)^2}{2\sigma^2}} \approx 1 + (\dots)^2 \dots$$

$$(\delta g)^2 = \left(\frac{2}{\ }\right)^2 \delta h^2$$

$$+\left(\frac{-4h}{t^3}\right)^2 (\delta t$$

Δh

δh

uncertainty in h

$\frac{\partial g}{\partial h}$

derivative of g wrt h

$\neq \cancel{\frac{\delta g}{\delta h}}$