

A statistical approach to establish the functional relationship is termed as simple regression.

Dependent variable is also known as Response / Predicted variable, regress variable / output variable and is generally denoted as y .

Independent variable is also known as predictor variable, exploratory variables / regressor variable / input variable denoted by x .

Ex: For a plant growth, if we apply fertilizers

Plant growth - dependent variable (y)

Fertilizers - independent variable (x)

Classification of Regression Analysis:

1. Univariate Variable - prev example: One dependent one I.O var

2. Multivariate Variable - many DV
many IDV

Ex:

Linear regression:

> Relationship is linear b/w D and ~~IDV~~ DV, ~~non~~

Non linear regression:

> Relationship is not linear b/w D and DV.

relationship

cited variable
usually denoted

variable /
variables

1D and 1DV is simple linear (SISO)

1D and many DV is (MISO)

Simple Linear regression

multiple regression

logistic regression

Ridge regression

PCA

LDA

partial least squares

Lasso regression

Conditions	Example
$y_i = \beta_0 + \beta_1 x_i + \epsilon_i$ where y_i is value of ith obs of the D.V. in the sample	—①

Sample consists of
set of data points
with n observations
 (x_i, y_i) where $i = 1, 2, 3, \dots, n$
and the functional
form is written as
eqn ①

Some

x_i is the value of i th observation of the independent
variable of the sample.

ϵ_i is random error which is called residuals.

β_0, β_1 are regression parameters or regression coefficients.

$$y_i = \beta_0 + \beta_1 x_i + \epsilon_i \quad —①$$

$$y_i = \beta_0 + \beta_1 \ln(x_i) + \epsilon_i \quad —②$$

$$y_i = \beta_0 + \frac{1}{1 + \beta_1} x_i + \epsilon_i \quad —③$$

$$y_i = \beta_0 + e^{\beta_1} x_i + \epsilon_i \quad —④$$

Eqn ① & ② are linear regression models although reln b/w x and y are not linear.

Eqn ③ & ④ are examples of non linear regression since the relationship b/w dependent variable y and regression coeff β_1 is non linear.

Evolution of regression:

Galton's theory of regression:

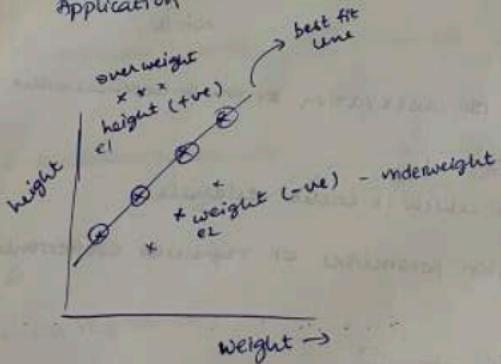
905 adults }
205 families }
avg ht >
of parent
mean value
of gen (77in)
children
shorter

Theoretical view

Geometric

Mathematical

Application



Error = Actual value - Predicted value

$$e_1 = y_1 - \hat{y}_1$$

$$e_2 = y_2 - \hat{y}_2 \quad (\text{based on slope} \times \text{Geometry})$$

$$e_3 = 0$$

relax b/w

since
regression

ing ht >
Fparent >
mean value
of gen t_{gen}
brother
sister

$$y = mx + c \quad (x, y) \quad ①$$

$$\text{LSM} : \rightarrow \min_{\text{for}} \sum_{i=1}^n (y_i - \hat{y}_i)^2$$

$$\rightarrow (y_1 - \hat{y}_1)^2 + (y_2 - \hat{y}_2)^2 + \dots + (y_n - \hat{y}_n)^2 \quad ②$$

$$\text{now } \hat{y}_1 = mx_1 + b$$

$$\hat{y}_2 = mx_2 + b$$

Substitute the value of \hat{y}_1, \hat{y}_2 in eqn ② we get,

$$(y_1 - (mx_1 + b))^2 + (y_2 - (mx_2 + b))^2 + \dots + (y_n - (mx_n + b))^2 \quad ③$$

$$(a-b)^2 = a^2 + b^2 - 2ab$$

$$= (y_1^2 - 2y_1(mx_1 + b) + (mx_1 + b)^2) + \dots + (y_n^2 - 2y_n(mx_n + b) + (mx_n + b)^2)$$

$$\text{now expand } (mx_1 + b)^2 \quad (a+b)^2 = a^2 + b^2 + 2ab$$

$$= ((y_1^2 - 2y_1(mx_1 + b) + (mx_1)^2 + b^2 + 2mx_1b) +$$

$$((y_2^2 - 2y_2(mx_2 + b) + (mx_2)^2 + b^2 + 2mx_2b) + \dots$$

$$((y_n^2 - 2y_n(mx_n + b)$$

$$= (y_1^2 + y_2^2 + \dots + y_n^2) - \cancel{2my_1x_1} - \cancel{2my_2x_2} - \dots - \cancel{2my_nx_n}$$

$$- 2by_1 - 2by_2 - \dots - 2by_n$$

$$= (y_1^2 + y_2^2 + \dots + y_n^2) - 2m(y_1x_1 + y_2x_2 + \dots + y_nx_n)$$

$$- 2b(y_1 + y_2 + \dots + y_n) + m^2(x_1^2 + x_2^2 + \dots + x_n^2)$$

$$+ 2mb(x_1 + x_2 + \dots + x_n) + (b^2 + b^2 + \dots + b^2)$$

Acc to least squares theory:

$$\bar{xy} = \frac{x_1y_1 + x_2y_2 + x_3y_3 + \dots + x_ny_n}{n}$$

$$n\bar{xy} = x_1y_1 + x_2y_2 + \dots + x_ny_n \quad \text{--- (1)}$$

similarly,

$$\bar{y} = \frac{y_1 + y_2 + \dots + y_n}{n}$$

$$n\bar{y} = y_1 + y_2 + \dots + y_n \quad \text{--- (2)}$$

$$\bar{x^2} = \frac{x_1^2 + x_2^2 + \dots + x_n^2}{n} \quad \text{--- (3)}$$

On substitution we get,

$$\begin{aligned} SE &= n\bar{y}^2 - 2mn(\bar{xy}) - 2bn\bar{y} + m^2n\bar{x}^2 + 2mbn\bar{x} \\ &\quad + nb^2 \end{aligned}$$

on differentiation $\therefore y = mx + b$, m, b are parameters

↓ apply

partial differentiation

$$\frac{\partial SE}{\partial m} \Rightarrow -2n\bar{xy} + 2mn\bar{x}^2 + 2bn\bar{x} = 0$$

$$\Rightarrow -\bar{xy} + m\bar{x}^2 + b\bar{x} = 0$$

$$\Rightarrow m\bar{x}^2 + b\bar{x} = \bar{xy}$$

$$\frac{\partial}{\partial n} (x^n) = nx^{n-1}$$

$$\text{now divide by } \bar{x} \Rightarrow m \frac{\bar{x}}{\bar{x}} + b \left[\frac{\bar{x}}{\bar{x}} \right] = \frac{\bar{y}}{\bar{x}}$$

compare with $y = mx + b$

$$\therefore \text{one point } \left(\frac{\bar{x}}{\bar{x}}, \frac{\bar{y}}{\bar{x}} \right)$$

$$\begin{aligned}\frac{\partial S_E}{\partial b} &= -2\bar{y} + 2mn\bar{x} + 2nb = 0 \\ &= -\bar{y} + m\bar{x} + b = 0\end{aligned}$$

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

$$(\bar{x}, \bar{y})$$

$$\text{slope} = \frac{y_2 - y_1}{x_2 - x_1}$$

$$= \frac{\bar{y} - \frac{\bar{y}\bar{x}}{\bar{x}}}{\frac{\bar{x} - \frac{\bar{x}^2}{\bar{x}}}{\bar{x}}} \quad \text{LCM}$$

$$m = \frac{\bar{x}\bar{y} - \bar{\bar{y}}}{(\bar{x})^2 - (\bar{x}^2)} = \frac{\text{covariance}(x, y)}{\text{variance}(x)}$$

Note:

$$\begin{aligned}\text{cov}(x, y) &= E(x - \bar{x})(y - \bar{y}) \\ &= E(n\bar{x} - n\bar{x}\bar{y} + \bar{x}\bar{y} + \bar{x}\bar{y}) \\ \Rightarrow E(xy) &= -\bar{y}\bar{x} - \bar{x}\bar{y}\end{aligned}$$

$$\bar{x}y - \bar{xy}$$

$$\text{var}(x) = E(x - \bar{x})^2$$
$$= E(x^2 - 2\bar{x}x + \bar{x}^2)$$

$$= E(x^2) - 2(\bar{x})^2 + \bar{x}^2$$

$$= \bar{x}^2 - (\bar{x})^2$$

$$\frac{\bar{x}^2 - (\bar{x})^2}{N-1} = 39.82$$

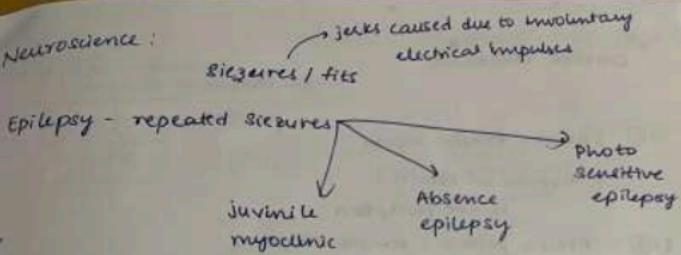
$$\frac{\bar{x}}{N}$$

$$\frac{\bar{x}^2}{N}$$

$$\frac{\bar{x} - \bar{y}}{\sqrt{N}}$$

$$\frac{\bar{x} - \bar{y}}{\sqrt{N}}$$

Neuroscience :



Unit - 5

Perception :

fundamentals }
spectrum }

Perception - able to sense
assumptions
other views
how we understand.

Perception - It is how an organism senses and
understands the happenings around.

+ve perception -ve perception

optimal perception

Grammar & language

chomsky hierarchy

↓

Perceive

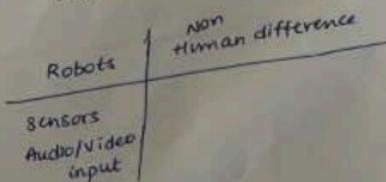
↓

[Sense organs]

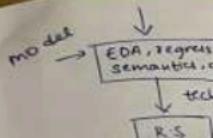
feel see hear taste smell
touch vision auditory olfactory

"Context Sense"

- Ex(1) Sender - Akhil - chocolates
(mistake of sender)
↳ -ve perception
- Ex(2) : Akhil - person - temple - pooja
(mistake of receiver)



- Automation
- Survey Score Analysis



22/9/23

Building
Interaction

Case study
What is Design thinking?

→ to solve a complex problem in simple way

→ ~~discovery~~ Empathy - discovery phase

Survey was conducted

to test knowledge of D.T
not using D.T

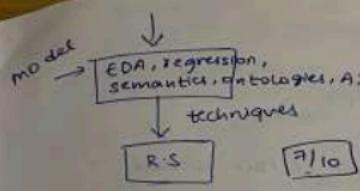
50000 responses using D.T

Double diamond process

3 box thinking

divergent and convergent

Brainstorming
cheat storming



* empirical - no evidence/proofs
 study based on observation/hypothetical scenarios

based on existing technologies

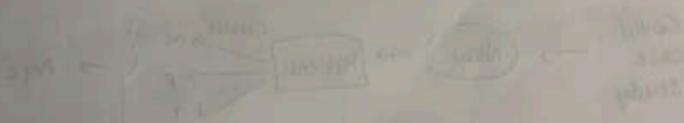
experimental - study

technique: empirical + experimental → how close to real.
 D-T methods chosen. ↓
 real time data

22/9/23

Building a Evolutionary model for Brain - computer interaction

Worm2 <--> Worm1



Unit-4:

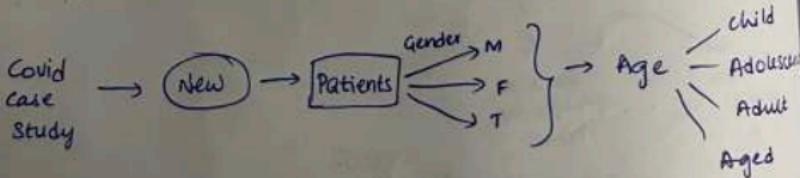
Central Limit theorem (CLT):

- > if you want find medicines for certain disease we need sampling.
- > for sample, if it works well it works well for population.
- > focuses on problem start to find cause of prob start in generalized manner.
- > cause → RNA (virus)
DNA → responsible for mutation.

if a disease effects blood vessels,

if a " " DNA/RNA, it takes long time to find medicine

Population \rightarrow Sample



Sample
when n >
directly

n ≤ 25

• 25

• There are

ex: Covid

Theorem

distrib

mean

R.V

norm

var

fr

> N

Un

sample size of
when $n \geq 30$ for a population of 100, CLT is
directly applicable.

$n \leq 25$, CLT can't be applied

$25 < n < 30$, it is based on probability values

there are limitations for CLT:

Ex: Covid C

Theorem: Let X be an independent identically distributed random variable with the finite population mean μ , finite population variance σ^2 then, a R.V converges in distribution to the standard normal variables as $n \rightarrow \infty$ with mean μ , and variance (σ^2 / n) . Here, n is the size of sample from given distribution.

No matter what is the shape of the population, is distributed or sampling, it works well when size of ~~this~~ population is large.

Limitations:

It is not applicable for pareto distribution ($\mu = \infty$)
cauchy distribution. ($\mu = \infty$)

problem:

A population consists of 5 numbers: 2 3 6 8 11
Consider all possible samples of size 2 which can
be drawn with replacement from this data. Find
mean, standard deviation of the population.

② find mean of sampling distribution
③ find s.d. of sampling distribution of means

$$\Rightarrow \text{mean} = \frac{\sum x}{N} = \frac{2+3+6+8+11}{5} = 6$$

$$s.d. = \sqrt{\frac{\sum (x - \bar{x})^2}{N}}$$

$$= \sqrt{\frac{(2-6)^2 + (3-6)^2 + (6-6)^2 + (8-6)^2 + (11-6)^2}{5}}$$

$$= \sqrt{10.8} = 3.29$$

② $n=2$ $N=5$ total = $5^2 = 25$

$$\Leftrightarrow (2, 2) (2, 3) (2, 6) (2, 8) (2, 11)$$

$$(11, 11)$$

corresponding samples:

2	2.5	4	5	6.5
2.5	3	4.5	.	11

② $\frac{\sum (\text{all values})}{25} = 6 \rightarrow \mu_{\bar{x}} = \mu$ (where \bar{x} is sample)
 $25 \bar{x} = \sigma$

Problems

Solutions Applying

① Applying Evolution
Interaction (B)

② children suffer

③ patients suffer

④ Treating the

⑤ Human Bra

⑥ Recommended
solving s

⑦ Computer

⑧ Enhancer

⑨ refrainin

⑩ Treating

Epilepsy ..

Absence ep
seizu

C/O
(symptoms)

Problems

Solutions Applying cognitive science → (Given problems,
apply cognitive
science for mid-2)

Unit-5

- ① Applying Evolutionary theory for Human Brain Interaction (BCI)
- ② Children suffering with depression
- ③ Patients suffering with absence epilepsy ["broader family of epilepsies"]
- ④ Treating the vision of blind.
- ⑤ Human Brain Robotic Interaction (HBI)
- ⑥ Recommending knowledge to enhance problem solving skills of a child / student
- ⑦ Computer Accessibility
- ⑧ Enhancing IQ, EQ of a child
- ⑨ reframing the education / quality enhancement
- ⑩ Treating the disabled - Normal Interaction.

Epilepsy --

Absence epilepsy :

↓
seizures (jerks)

C/O → Headache
(symptoms) Nausea
Vomiting
Scared to sleep

ISSUES!

- Issues!

 - ① Predicting Absence epilepsy is tough.
(Symptoms / seizures are not seen on the outside
only the person having fits feels inside.)
 - ② people suffering with severe anxiety also face
suffocation. So, it is a medical complexity
if it to identify if it is caused due to absence
epilepsy / anxiety.

④ Current existing diagnosis process:

early

- | | |
|---------------------------------------|-------------------|
| early | |
| 1. CT Scan - O/P (Image) | 5 mins
2D Img |
| 2. MRI Scan - O/p (Image)
(faster) | 25 mins
3D Img |
| 3. EEG - Signals/graphs | 1hr |

Although reports show normal for brain abnormality we cannot say that the patient does not have epilepsy.

- ⑤ loss of memory and learning becomes slow.

Medication:

1. Heredity (70% Gen - check if they have epilepsy)
2. behaviour of child and surroundings
3. Advance ~~MRI~~ EEG - 24-48 hrs (50K-100K)
not advised at every level.

if (severe) {
(blood clots)}

do:

surgery ↙ Robotics
Human

}

- breathing exercises
- Yoga (patient can't close eyes for too long)
- for nerves relaxing - tablet: chlorazepam
- can't stay too long at night
- they can't climb heights
- they can't use mobile phones (max: 30-min)
- loss of memory
- learning becomes slow

27/9/23

Cognitive Approach to treat children suffering with
Absence epilepsy [0 - 18 yrs]

[10 - 14] ← target audience
(hormonal changes)

Issues:

- (i) Lack of memory
 - (ii) Attention
 - (iii) Diagnostic Issue.
- } goal is to enhance.

Prototype - implementation on a small

Model - design / architecture

-
Bullying / Academic Pressure / Family issues:

Anxiety

Others

- ① Financial
- ② Community

we
Bullied person

levels

min on-screen time [25 - 55] max on-screen time

Limitations:

- ① too much of animations cause dry eyes → Visual effects
- ② threshold for anxiety → game should not cause anxiety.
- ③ Audio effects.

collective

After

AUC

Game should be designed for

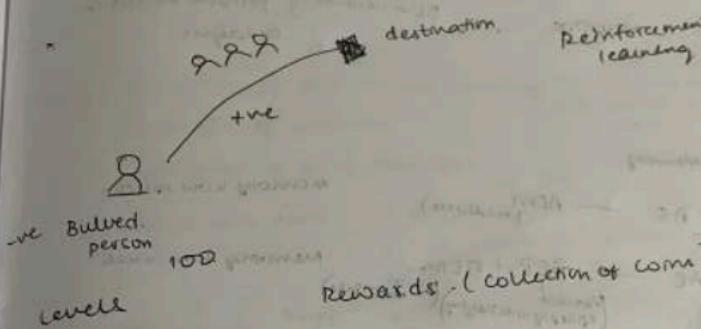
blated*

M
F
TG } because of to serve our emotional needs better.

All ← to overcome legal issues

Mind-body problem → basing on thoughts how we perceive others

{ mental representation }



Collection of Coins

Mango (5pts)
Rapaya
Pineapple (5)

Orange (5)
Papaya (5)

Grapes (5)

NLP
(Random Number Generator)

After 25 points

M P O P G (Starting letters of all names displayed)

Audio/Video → after a min → questions can be asked.

27/7/23

Image processing → to capture facial expressions
 of a child so that Psychiatrist,
 Neurosurgeon can access the emotions
 of the child

(CNN)

(Inception
 (to capture state of patient))

o/p: Un stable

Neurons

DLT neurons → perform inception
 on layers.

Memory

AE — AEM (medicines)

Memory how much?

AE — AEP + AEM →
 (Absence (epilepsy with playing) (with medicines))

Memory how much.

compared using street Association Rule memory.

Ram 4 → 8 (with medicines)

Shyam 3 → 7/8 game doesn't work.

If > 8 . game ✓ (feasible)

(with medicines + playing)

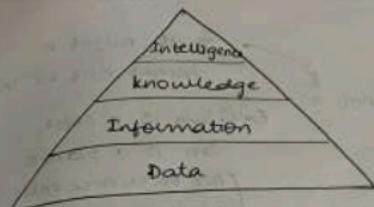
Next class:

Perception evolution

Theory of Information processing

29/9/23

Fundamentals of AI



Pyramid of Data

Data - unorganized; raw; have meaning (unorganized form of raw fact is data)
collection of resources
- unorganized form of raw data.

Problems with data: 1. Ambiguity *

2. no uniqueness / Handling duplicates *

3. Inconsistency

4. Handling null values

* Data Preprocessing steps: Adding miss values
Adding Null values

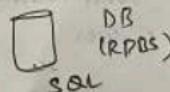
Ex:
Akash 25 Suraj
52 CSE CSB
Sumanth 19 LPA MI
DSA Bhawana

lack of clarity
(what +)

Ex:-

R.NO	Name	T.	College	Branch name
20	Satwik	100	VNR	CSB

i. organized form of raw fact / data is information.



can information be unstructured? Yes.

Knowledge:
(truth of a fact)

fact is a
universally accepted
stmts.

definitions: → not a
universally
accepted
stmt

→ belief systems

Truth might or
might not be true

Ex: ① Sun is a star
Sun is a planet
(Acc to science false)
(Acc to Hinduism true)

② Earth is round
Earth is flat

Acc to flat theory, Earth is
flat

③ Does God exist

Why should we consider non factual stmts / belief
systems?

> ② we can't prove stmts that are non factual.

So, we use ontologies., metaphysics

① ~~evidences~~ evidences to support facts.

② to prove non factual stmts

③ to find relationship b/w entities which are dependent on other
entities

mind / brain
Perception

= Sensation (feel using sensory organs)

↑
Perception of sensation

Sensation of perception

Ex: ① Video shared in app.
② Child cuts over dead body
(lit relation)
(no relation)

Ex: Neem ③ Around neem tree → Your tongue starts to feel bitter

④ Under coconut tree → you feel like the coconut falls

Vestigo: fluid.
brain ear

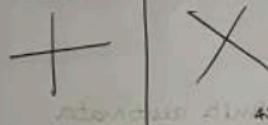
Nothings (non) → example for both.

If heavy fluid → caused
vomiting.

Cognitivism Approach:

Game:

Elephant | Camel



8max moves

8max moves

biasness - when our perception is biased and not up to optimality, AI model will be biased.

Formulating the hypothesis :-

- ② Building computational model
- ③ Testing and Evaluation
- ④

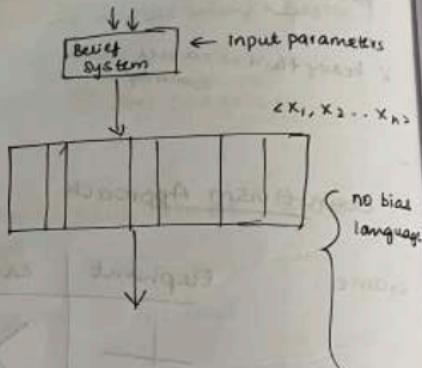
4/10/28

Approach to Cognitivism:

- ① Hypothesis
- ② Computation
- ③ Implementation

(Good) *

→ Representation
→ computation



1. Start and stop



so, finite automata

$$M = \langle Q, \Sigma, q_0, \delta, F \rangle$$

2. pattern recognition → languages

$$L(n) = \{a^n b^n \mid n \geq 0\}$$

$\{ \epsilon, ab, aabb, \dots \}$

infinity cannot
be considered.

for any hypothesis, having language is important
and limit is important

What is the connection of language to chemistry?

Monty Hall - problem of cognitive Analytics [3 doors, 1 goat]

Action to perform in a structured format, automata theory is applied.

Where FLAT is used in Real time?

All AI techniques are used in Automata theory

What is representation & models?

diagrams

Symbolic representation

Pictorial representation

Semantic representation

Propositional representation

Difference b/w database and knowledge base.
↓ facts / inferences

Aristotle - Father of Biology

classification / clustering (taxonomy)

believes in philosophy not in scientific study.

which 2 plants have same leaf and
~~food~~ segregated leaves

knowledge base.

Reinforcement learning

- 6/10
M
- ① how knowledge base is stored in human mind.
 - ② how to diff b/w human mind & body.
 - ③ how logical entities stored and represented.
 - ④ how to represent these entities
 - ⑤ So, Q. A.

Terminologies: (8m) *

- ① Structuralism
- ② Functionalism
- ③ Rationalism
- ④ Nativism
- ⑤ Empiricism
- ⑥ Gestalt Psychology

6/10/23

Maximum Likelihood Estimation (θ) -

- to estimate
 - parameters - the factors that effect a variable
 - Let $\langle \alpha, \beta, \gamma \rangle$ be 3 different variables.
 \checkmark (rain)
 - $\langle \text{clouds}, \text{water vapour} \rangle$ - parameters
 - > let $\langle \alpha, \beta, \gamma \rangle$ be 3 different variables belonging to set S₁ based on the constraints or factors. If the variable α gets affected and on computing the value, the change of difference is termed as parametric value.
 - > One of the notation for parameter is θ
 - > what is the importance of θ value ?
- Find out:
what is threshold
freq in association
rule mining
- MLE - In statistics, MLE is a method of estimating the parameters of probability distribution by maximizing the likelihood function so that the assumed statistical model is most probable. It is generally a function defined over a sample space
- It determines the value for parameters of a model, parametric values are found such that they maximize the likelihood function that the process is described in the model.

Problem: Suppose x is a discrete random variable with the following probability mass function. $0 < \theta < 1$ is a parameter. Consider the following 10 independent observations.

x	0	1	2	3
$P(x)$	$\frac{2\theta}{3}$	$\frac{\theta}{3}$	$\frac{2(1-\theta)}{3}$	$\frac{1-\theta}{3}$

(3, 0, 2, 1, 1, 3, 2, 1, 0, 2, 1)

What is the θ value?

> Sample is $\langle 3, 0, 2, 1, 1, 3, 2, 0, 1, 0, 2, 1 \rangle$

$$L(\theta) = \prod_{i=1}^n P\left(\frac{x_i}{\theta}\right)$$

$$L(\theta) = P(X=3) P(X=0) P(X=2) \dots P(X=0)$$

$$= \left(\frac{1-\theta}{3}\right) \left(\frac{2\theta}{3}\right) \frac{2(1-\theta)}{3} \frac{\theta}{3} \frac{(1-\theta)}{3} \frac{2(1-\theta)}{3} \frac{\theta}{3} \frac{2\theta}{3} \frac{2(1-\theta)}{3}$$

$$L(\theta) = \left(\frac{2\theta}{3}\right)^2 \left(\frac{\theta}{3}\right)^2 \left(\frac{2(1-\theta)}{3}\right)^3 \left(\frac{1-\theta}{3}\right)^2$$

$$\log(L(\theta)) = \log\left(\left(\frac{2\theta}{3}\right)^2 \log\left(\frac{\theta}{3}\right)^2 \log\left(\frac{2(1-\theta)}{3}\right)^3 \log\left(\frac{1-\theta}{3}\right)^2\right)$$

$$= 2 \log\left(\frac{2\theta}{3}\right) + 2 \log\left(\frac{\theta}{3}\right) + 3 \log\left(\frac{2(1-\theta)}{3}\right) + 2 \log\left(\frac{1-\theta}{3}\right)$$

$$= 2 \left[\log\left(\frac{2\theta}{3}\right) + \log\left(\frac{\theta}{3}\right) \right] + 3 \left[\log\left(\frac{1}{3}\right) + \log(1-\theta) \right]$$

$$L(\theta) = C + 5 \log \theta + 5 \log(1-\theta)$$

Apply differ
 $\frac{d}{d\theta}(L(\theta))$

\Rightarrow

Max

Ave:

> It'll
val

> NO

Prob

Apply differentiation:

$$\frac{d}{d\theta}(\ell(\theta)) \Rightarrow \bullet + \frac{5}{\theta} + \frac{5}{(1-\theta)}(-1)$$

$$\frac{5 - 5\theta + 5\theta}{\theta(1-\theta)} = \frac{5}{\theta(1-\theta)}$$

$$\Rightarrow 0 = \frac{5}{\theta} - \frac{5}{(1-\theta)}$$

$$= \frac{5(1-\theta) - 5\theta}{\theta(1-\theta)}$$

$$5\theta = 5(1-\theta)$$

$$2\theta = 1$$

$$\theta = 0.5$$

$$\begin{aligned} \theta &= 0.5 \\ \theta &= 0.5 \\ (\cancel{\theta = 0.5}) \end{aligned}$$

Markov chain process:

Add:
It'll not consider previous values, considers current values

NO memory used since dynamic^mnature.

problem:

$$\begin{bmatrix} 1/3 & 1/3 & 0 & 1/3 \\ 0 & 1/2 & 1/4 & 1/4 \\ 1/4 & 0 & 1/2 & 1/4 \\ 0 & 0 & 1/3 & 2/3 \end{bmatrix}$$

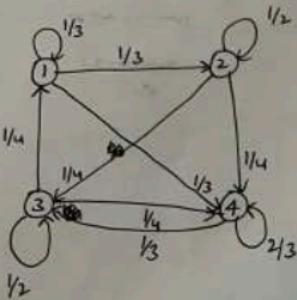
Determine if the following transition matrix is ergodic in nature (ergodic - time complexity of transition b/w states the process is minimal).

UNIT - 4

1. classify + geometric
2. Derive least
3. Expla
4. Expla sci.
5. DIS
6. WE
7. E

$$\begin{matrix} & 1 & 2 & 3 & 4 \\ 1 & \left[\begin{array}{cccc} 1/3 & 1/3 & 0 & 1/3 \\ 0 & 1/2 & 1/4 & 1/4 \\ 1/4 & 0 & 1/2 & 1/4 \\ 0 & 0 & 1/3 & 2/3 \end{array} \right] \\ 2 & \\ 3 & \\ 4 & \end{matrix}$$

$\langle 1, 2, 3, 4 \rangle$ are present states



Uniqueness :

- ① For all states, self loop is there i.e. it can travel any no of times (no need to store memory for states)
- ② from any state, we can reach all other states.
- ③ T.C is less

> widely used in neuroscience and to develop games.

Deep Learning :

- Images
- Patterns
- Neural Networks
- Memory
- Neurons - millions (10×10^{10})
- Hidden Layer *

> Difference between ML and Deep learning :

'cat' 'dog' 'lion'

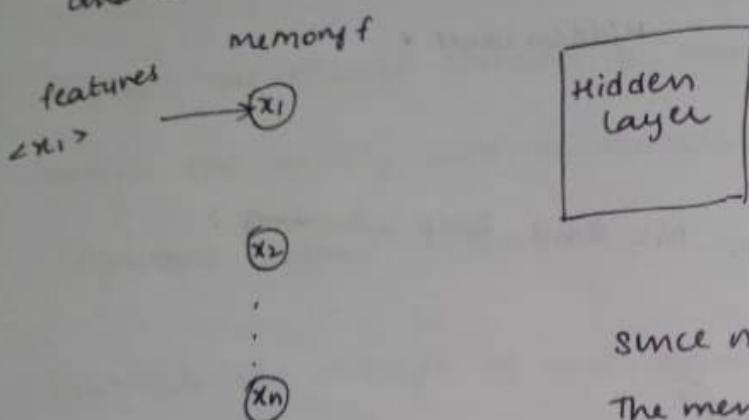
if you train 'tiger' for a D.L model, it automatically classifies cat lion into tiger family. Novelty of D.L.

Deep learning majorly comprises of neural network layers to simulate the behaviour of human brain comprising of millions of neurons, allowing to learn from large amounts of data which are structured and unstructured.

Ex: Consider set of animals 'cat', 'dog', 'lion'. DL can determine which features are most important to distinguish each animal from another whereas in M.L the hierarchy of features is established by human experts.

> computational model can be expressed using an activation function genuinely represented by Activation $f(x)$ which takes the input related to weights of the node.

Biased functions, neural structures, memory function and so on.



since mem i/p is in 1000
The memory associated with
association function is high

preprocess data in unstructured form

Why do we use Bias functions?

↓
wt of nodes > size of node

Classification of ~~Deep~~ Neural Network ?

1. Biological Neural Network (BNN),

Artificial Neural Network (ANN),

Neural Network (NN)

Convolution Neural Network (CNN)

Recurrent Neural Network (RNN)

RN Architecture

Long short Term Memory (LSTM)

Bi-directional LSTM

Gated Recurrent Unit (GRU)

continuous Time RNN (CTRNN)

classification of CNN (w.r.t. application) ***

1. VGG16 /
2. Alex Net /
3. Inception Net
4. ResNet
5. Google net X /

classification of D.L object detection models

1. R-CNN /
2. Fast R-CNN /
3. Faster R-CNN /
4. Cascade R-CNN
5. Mask R-CNN
6. Single shot Multi Box detector (SSD)
7. YOLO - You Only Look Once
8. Single shot refinement Neural Network
9. Refined Det
10. Retina Net

10

Auto

Autoencoders

1. ~~GAN~~ GAN
2. De-noising Autoencoders
3. Transformers
4. BERT

GPT-3

GPT-2

XLNet

ROBERT

Auto-immune deficiency (ch-2) - AMD

> their immunity attacks own immunity.

problems: skin allergy

dryness of eyes and mouth

asthma

breathing disabilities

rheumatoid Arthritis

swelling in ~~knee~~ joints and knee pain

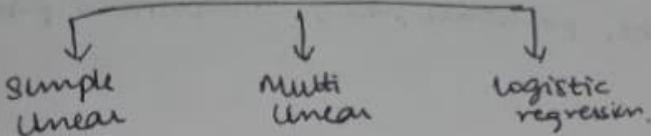
clenching of teeth

target audience
cause

1 - 0
2 - 1
3 - 1
4 - 1
5 - 1

13/10/23

Regression.



Examples of linear regression:

- ① A hospital maybe interested in finding how the total treatment cost of a patient varies with the body's weight of the patient
- ② A business school may like to know the relationship between the salary offered to the graduating students by recruiting the companies during their placements and their CGPA
- ③ E-commerce companies such as Amazon, flipkart, big basket would like to understand the number of customers visit to their portal and revenue.
- ④ Restraints would like to know the relationships b/w the customer waiting time after placing the order and net promoter score (NPS)
- ⑤ Banks and other financial institutions would like to understand the impact of rate of unemployment on the percentage of non performing asset.

Examples of multi-linear regression:

- ① The treatment cost of cardiac patient may depend on the factors such as age, past medical history, waist of the body, blood pressure etc.

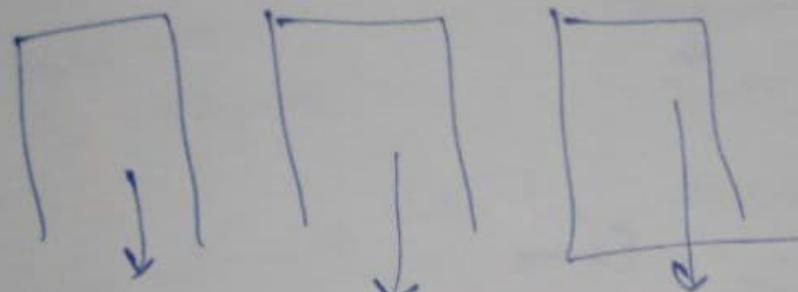
- ⑥ market share of a brand may depend on various factors such as price, promotion price, competitors price

Logistic regression examples :

- ① A bank may like to classify the customers based on risk such as low, medium, high risk customers under loan portfolio. Here, the response variable y takes 3 variables. Ex: $y=1$ (low risk)
 $y=2$ (medium risk)
 $y=3$ (high risk)
- ② Health service providers based on diagnostic tests may classify the patients as positive ($y=1$, presence of disease) or ($y=0$, in absence of disease)
- ③ Predict outcome of any sporting event for example: in case of football, the outcome will be win, loose or draw.
- ④ Sentiment about a product or service in social media can be classified as positive, negative or neutral. which enables an organization to understand the sentiments about the product/service. Organizations may also like to understand the reasons for negative sentiment if exist and take appropriate corrective actions.

- 1 survey → mindset
- 2 mid paper evaluation
- 3

Survey

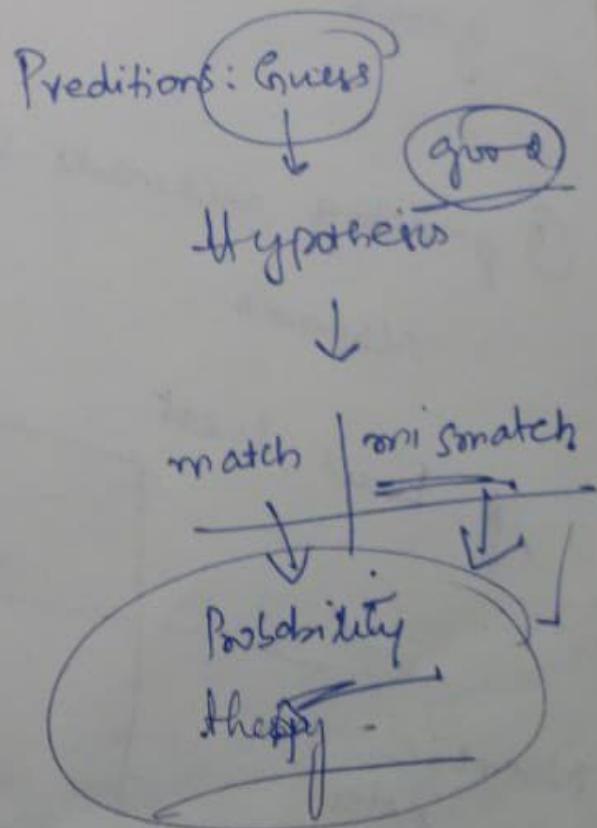
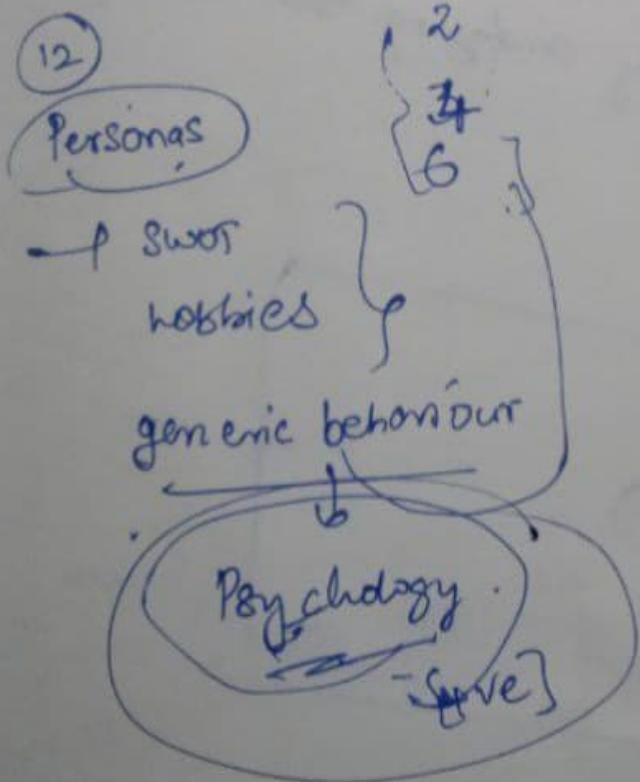


Survey
Responses

Answer
Sheets

Google
form.

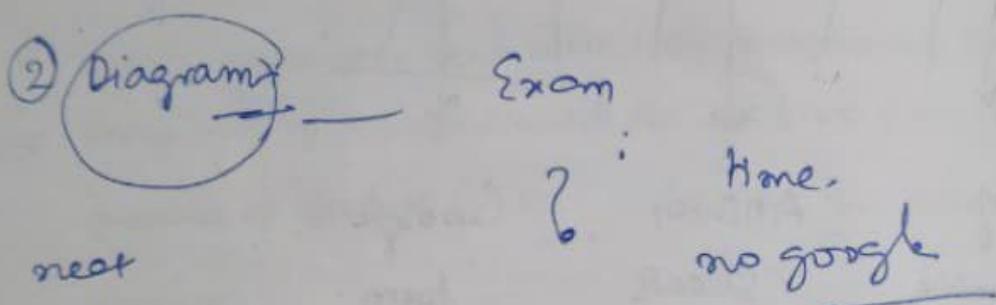
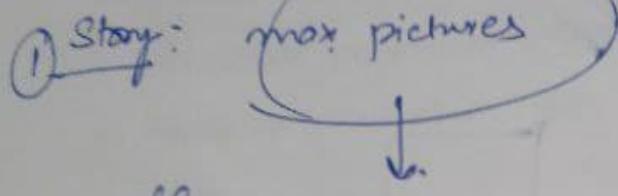
ROUND 12



mismatch

- ① Child → time constraint
 - ② Ambiguity for evaluator.
- evaluator

Survey: Genuine



neat

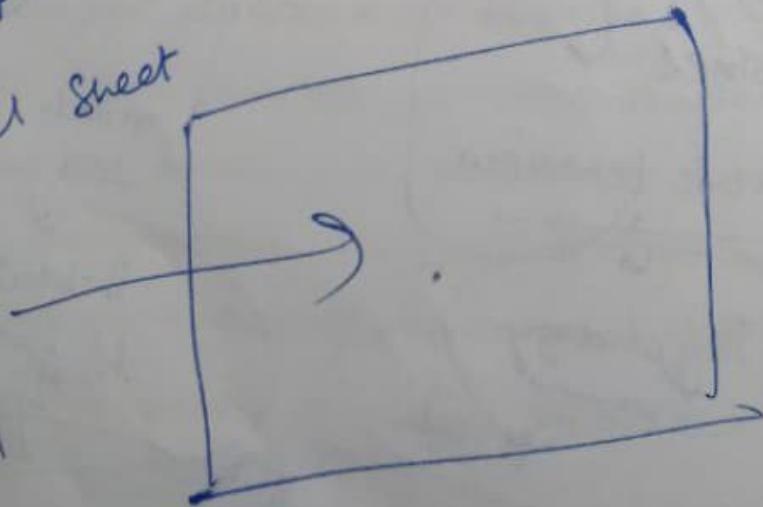
no time

google

- ① predicting midmarks by analyzing the Survey responses.

* Excel sheet

numeric data



25 m: 10

Survey Google form Answer sheet VNR

10 m → 10

8

23 1/2

if ($S > 7 \& A > 20$) → $4.5 \sqrt{5}$ noting.

{ Rule based classifier }

Score rank card

{ Data mining +
Association rule
mining +
Apriori algorithm }

FP growth

O/p.

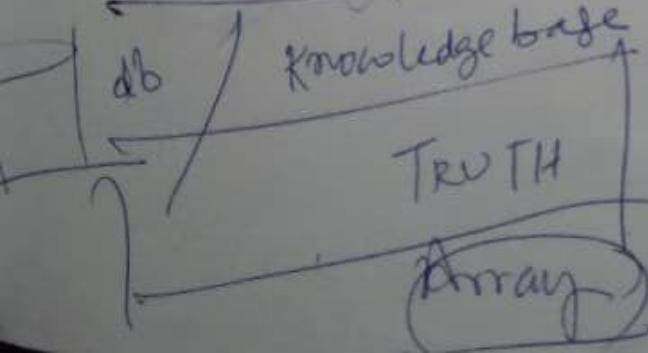
Excel

Rollno.	g	Google form
1		

VNR

⑤

Numeric



$m \times n$

matrices

Propose data structure

Analytics on Excel

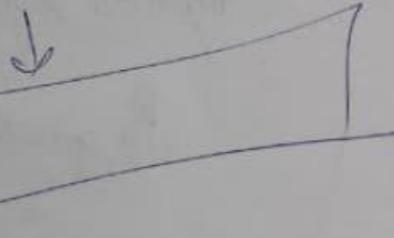
+ EDA

Attempted auction
meeting.

Individual summary:

group-

google forms \rightarrow 7.5



> 6 good

> 8 v. good

10 perfect

Gab van

↓
Data visualization

↓
Data scientist

Remarks:

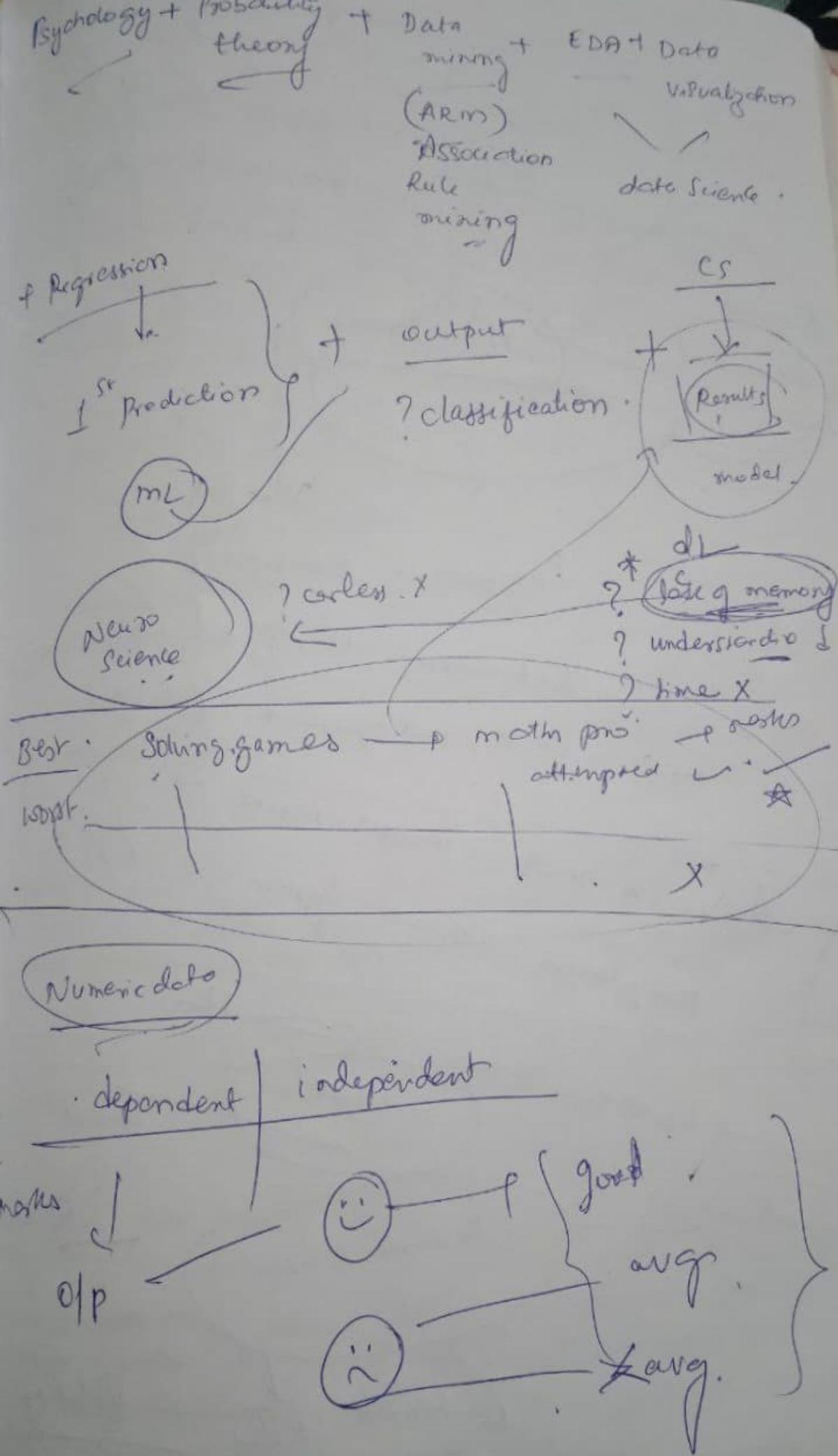
3D

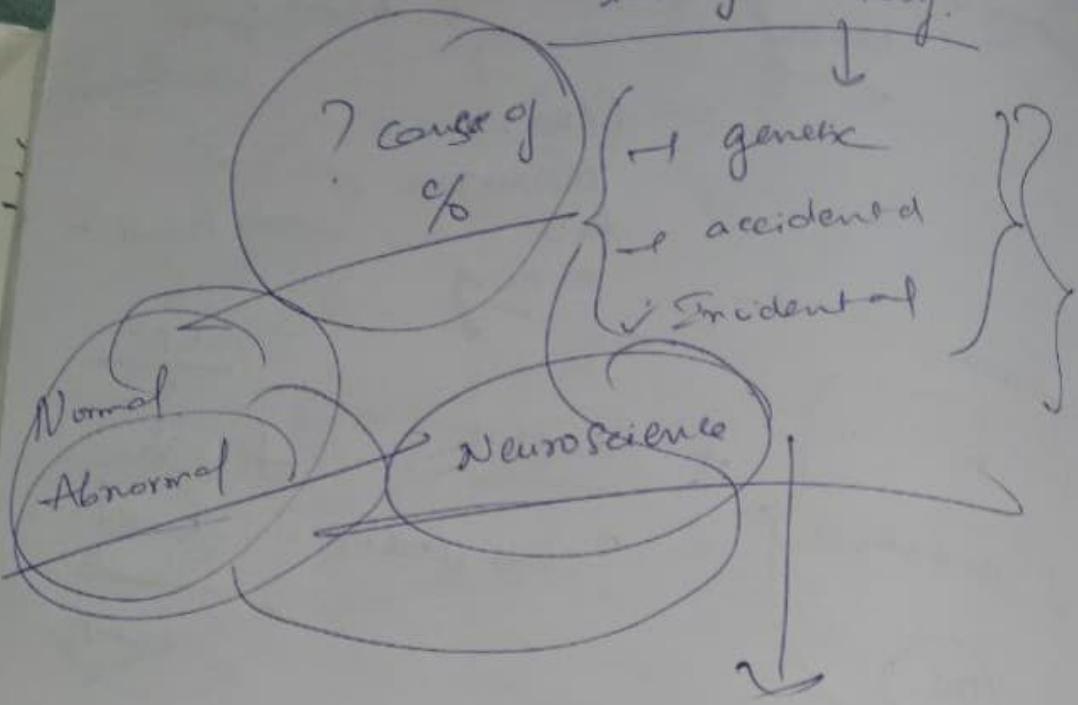
outliers

75 -

2.166

st 3.





Suggestion Measure.

- Behavioural therapies (Psychology)
- Stress management (line 1)

detect in motor nervous system + peripheral Nervous system + CNS

