Statistical Tests
↳ Parametric → distribution, statistic
↳ Non-parametric
↳ Sample does not belong to any interpretable distribution

Both will in a way employ p values over any final distribution to come up with results.

Parametric
→ t-test → (population var ✗, + Sample size ↑)
↳ z-test (population variance is known)

t-test → Has higher (broader) probs at tail as var is not surely known
↳ width ↓ samples ↑
lim → z-test

- t-test
  → One experimentation or data distribution based.
  ↳ Two data-distribution based
    ↳ Paired → same data set (var → same) coming from.
      ↳ Two different models (with or without 1-feature)
      ↳ Change in prediction mean.
      (scipt.ttest_rel(a, b))
      Null → $u_A - u_B = 0$
    ↳ Non-Paired (Welsch)

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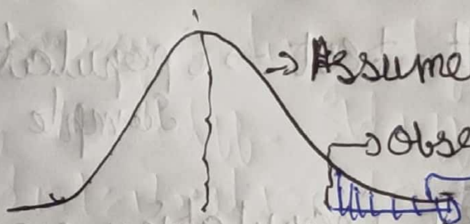
P-value → Assume distribution, hypothesize a statistic for that distribution

→ Distribution of hieght → Normal
Statistic → Mean of height.

→ Observation → P value tells/evaluates the probability of that statistic being equal or extreme than that distribution.



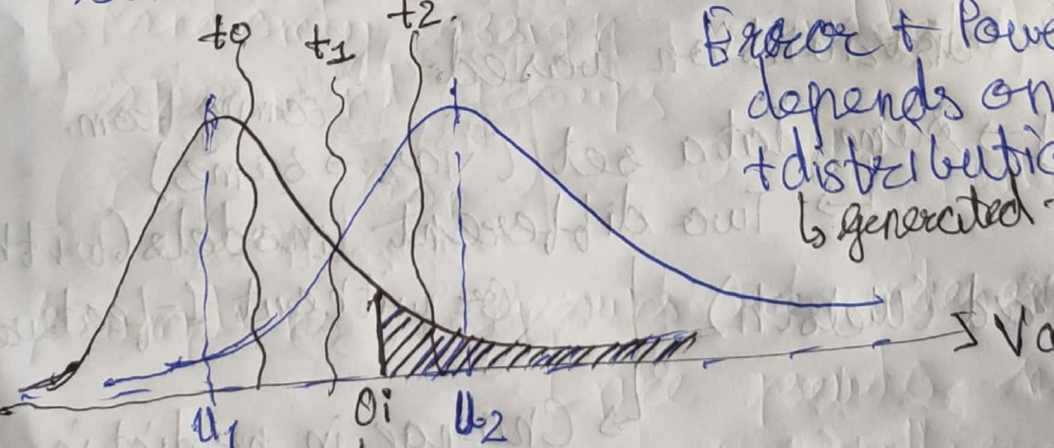
Now we introduce threshold = α = 5%

ERR-TYPE 1 → We say Obsi belong to some other dist when it belongs to the same dist

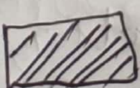
→ TYPE 2

→ We say Oi belong to this dist when it is from other dist

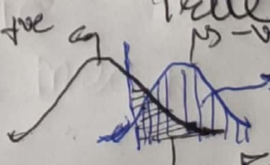
→ We want this p-val to be high as we wish to be right about our distribution + statistic



Error + Power of test depends on threshold + distribution → generated. → model choise

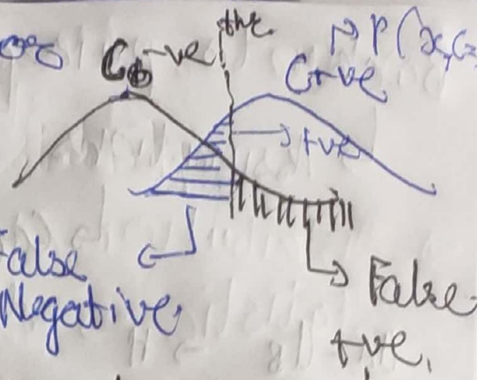
 → pi

Power of the test = True negative



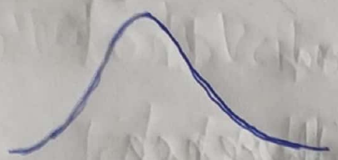
False Positive → TYPE 1 error

↳ You selected a thr



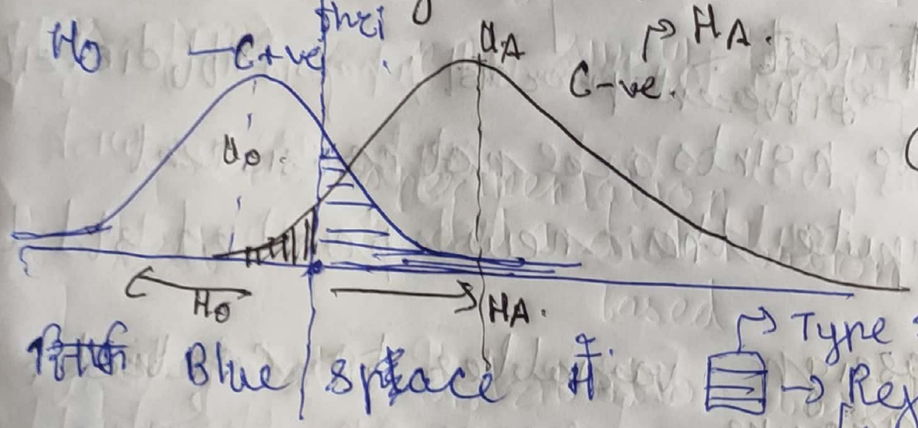
↳ Always contributed by probability of other class

★ Predicted +, Actual -ve = False Positive.



⇒ Power of test → ~~True Positive~~ False Negative

↳ Pr(reject H_0 | H_A is true).



▥ → Type 2 error (Belongs to u_A but classified as H_0)

Blue space H

▤ → Type 1 error
→ Rejection zone. +
~~(Inside C-ve)~~ ⊕
↳ Beyond threshold

Threshold give a value of height (x)

↳ Use $\frac{x - u_A}{std(H_A \text{ distribution})}$ to determine probability of this zone

Back to paired T-test

↳ Assumptions ↳ Same data-set.

↳ Continuous variable + Pseudo-Normal dist.

$u_A - u_B \rightarrow H$

↳ Follows t distribution

std- ~~distributions.~~ Computed ~~after pooling variance of two~~

Steps → Calculate corresponding difference.

↳ Stats, #, u_{diff}, std_{diff}

Use (Map on) T-distribution to know th p-values.

#

⇒ Unpaired T-test : → i. control groups.

↳ Different prior dist; → Diff distrib

↳ Data points are not consistent

↳ Compute the new pooled std dev

↳ Randomly assign variables to control + experiment groups

$(\bar{x}_{exp} - \bar{x}_{con}) \rightarrow 0$ Ho

→ Data within + between.

Assumptions → Groups are independent - Random by assign random shuffled data.

↳ are pseudo-normal.

↳ No outliers.

Prob of obs'd away from mean → 0

std t-test (2-mean) = $\sqrt{\frac{n_x s_{exp}^2}{n^2} + \frac{s_{control}^2 \times n}{n^2}}$

+ Degree of freedom → 9 samples ∴ $dof = 9-1 = 8$

↳ t-dist is (sample-size dependent)

↳ If not equal use the smaller one.

min(n_{exp}, n_{obs})

Diff in means → 1. Randomness chk

2. Assert no outlier in any data-class

3. Compute stats μ, σ $\left(\sqrt{\frac{\sigma_A^2}{n_A} + \frac{\sigma_B^2}{n_B}}\right)$, d of freedom.

4. Evaluate t-stat + pvalue.

5. State out inferences.

⇒ Pooled variance → If two group can be combined together to compute variance.

⇒ Power of test

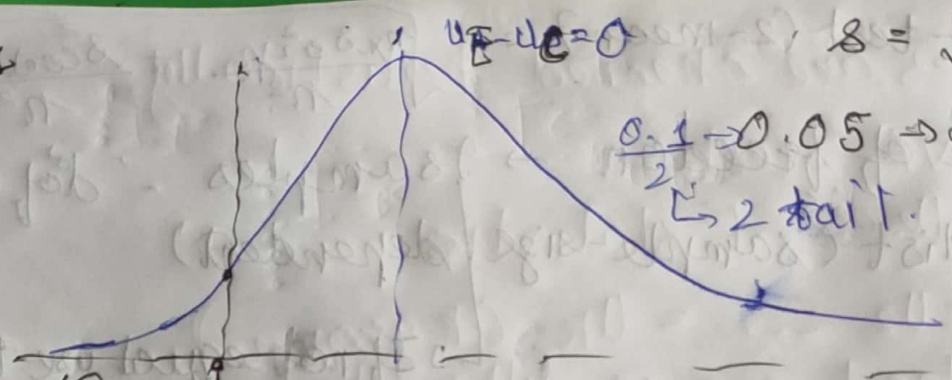
↳ Truly $\mu_{diff} = 5$ and we rejected $\mu_{diff} = 0$

~~↳ std~~ :

1. We get t-bound from α and std err part of $\mu_{diff} = 0$ test.

2. We use the t-bound and new mean, but same std-err to compute p val of a region.

Step 1

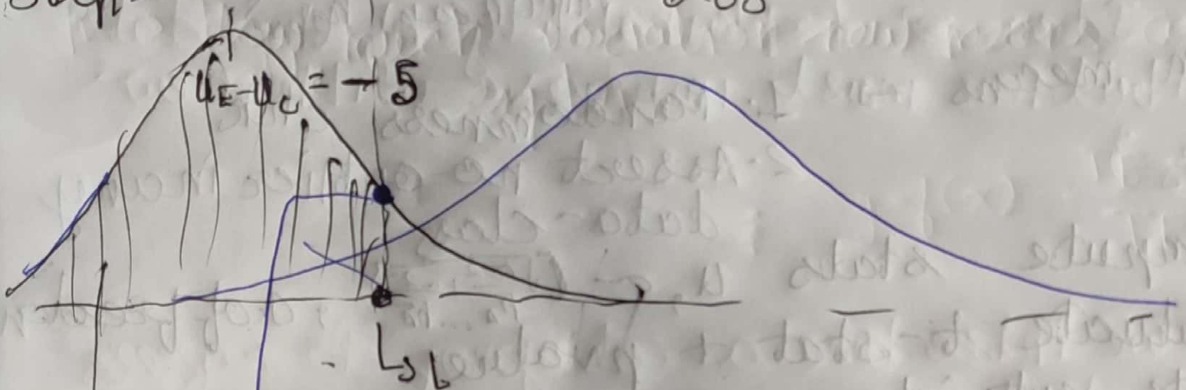


$S = \sqrt{\frac{S_E^2}{n} + \frac{S_C^2}{n}}$

$\frac{0.1}{2} \to 0.05 \to \alpha$
↳ 2 tail.

↳ $0 + t\,val_{0.05} \times S = $ L. bound.

Step 2



↳ This is $\frac{L - (u_E - u_C)}{S}$ → t value. (↱ (-5); ↱ stat)

p value

Power of test
⟵ (Rejection side)

Analysis of Variance :-
↳ Mean of many groups
Difference between
↳ Can take combinations
↳ chances of error will ↑

↱ Linear Regression
$P(y | x's)$ + P entire y
or
simply diff classes mean.

↳ All pairs are checked holistically;
↳ ANOVA test
↳ Uses F statistic

$H_0 \rightarrow \mu_1 = \mu_2 \cdots = \mu_k$ (k groups).
$H_A \rightarrow$ At least one is different.

(Side-Idea ⇒ Explainability of the data-distribution must improve with new means)
→ Inverse of residuals

↳ Should we introduce a category to regress the predictor
(If ANOVA → HA comes true go for it)

Category	A	B	C	
Sample size	160	208	64	
Mean	0.32	0.318	0.302	Values of y
SD	0.043	0.038	0.038	(any x)

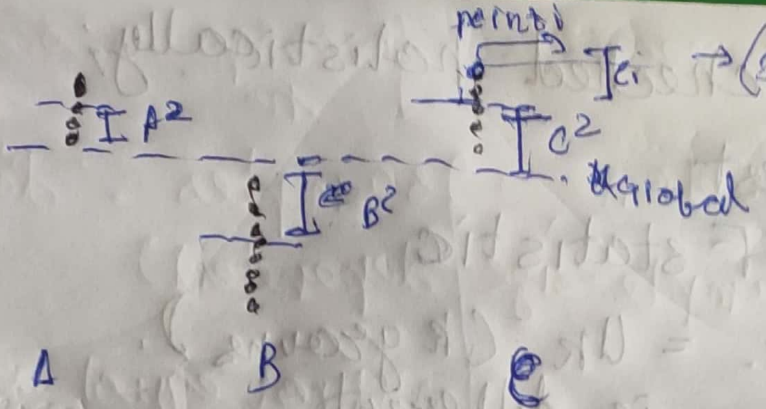
↳ Need to evaluate variation in mean and proof that it is/or not due to chance.
H_0 ↲ ↳ H_A

k → groups → MSG → $\frac{1}{k-1} \sum_{i=1}^{k} (\bar{x}_i - \bar{x}_{total})^2$
MSG: between groups

mean, etc. p val

data points
$MSE = \sum_{i=1}^{n} (x_i - x_{Global})^2$

$F = \frac{MSG}{MSE}$

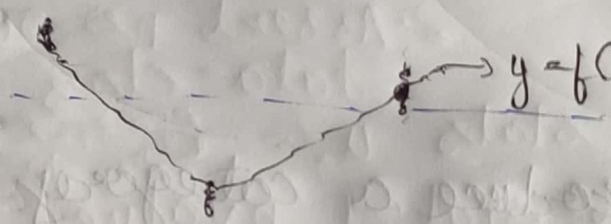


$\rightarrow (x_i - \bar{x})^2 = e_i^2 + C^2$

$$\frac{A^2 + B^2 + C^2}{(x_i - \bar{x})^2}$$

↳ Total error.

$R^2 \rightarrow$ How much variation new means are able to explain.



$\rightarrow y = f(x)$

$$\frac{TE \leftarrow \text{Leftout error}}{TE}$$

Difference between

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