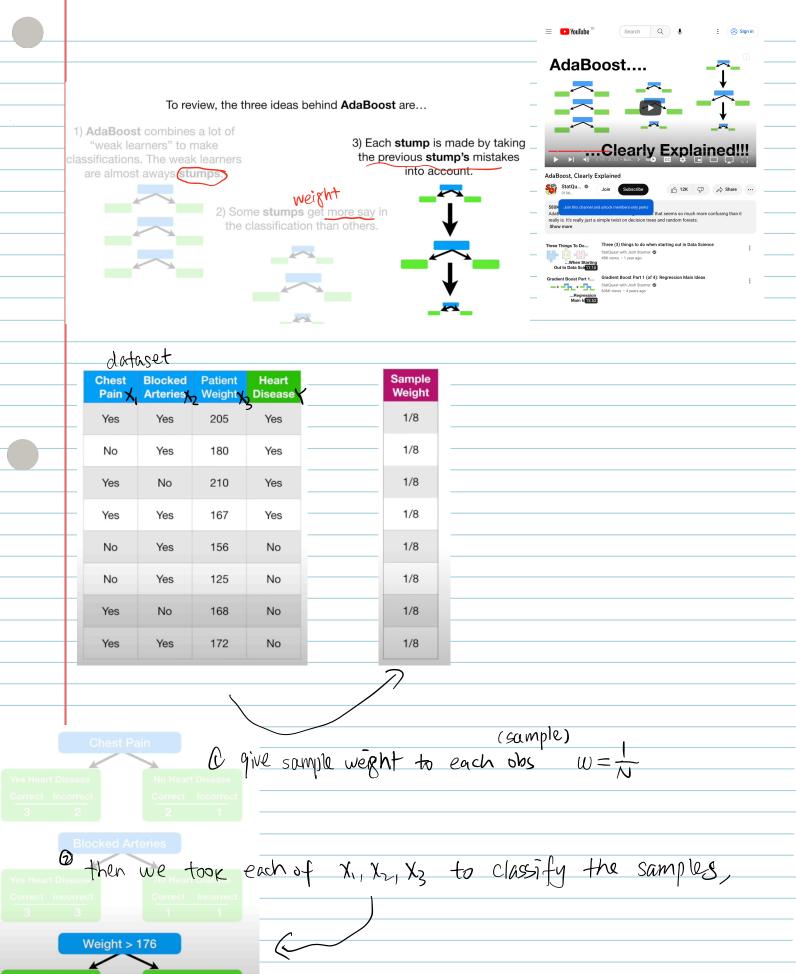
Begging = Bootstrapping + Aggregation. #η Τγ. Trz m Te Boutstrapping. in average of obs in Tr goes to one of Iri Tz Trz) Tr, Trn 7 if there is a strong attr in original tree, it might be used everywhere in Tri. (then trees might look the same) Tz Trz) Tr Irn $\chi_{j}, \chi_{S} - \chi_{p}$ $X_{i}, X_{2} \cdots X_{p}$ ~ ` ` So we randomly I build tree. select Jp- of 00 ď `0 attrs

> \Downarrow predict the test ₩n Tγ roughly 3 of obs in Tr does not go to any of Trz. any tree did not used observation Xx then used to make a prodiction for Xx Out of begging error i each tree used to predict has an error. OBE #tree did pridiction i=1 Errori Random forest can run Parallell, cause each tree does not depend on other Boosting trees are different, they run sequential.

for Boosting Tree, we mainly do Adaptive Boosting Dicla boost Busting: 2 () sequential Peach new tree tries to correct the error of the first one. Ada boost is doing mostly on weight. ecourse did not on using the connect on using the connect on using the connect on the main of the connect of th -2344 A + 0.69 I sequantial 2745 Σ B + 0.97 L sequetial weight

https://www.youtube.com/watch?v=LsK-xG1cLYA&t=378s



³then we calculate givi index for each of them Gini Index Giri Index To the belong of the propertion of the belong $I(A) = 1 - \sum_{k=1}^{m} p_{k}^{2}$ Gini Index 0.5 Weight > 176 Gini Index 0.2 smaller gini index, better impurity, Weight > 176 (4) we select this one as it has the smallest And when a stump does a terrible job and the Total Error is close to 1... G then we need to redefine the new weights Amount of Say = $\frac{1}{2} \log(\frac{1 - \text{Total Error}}{\text{Total Error}})$ 0.2 0.4 Total Error 0.6 to increase New Sample = sample weight $\times e^{a}$ nount of say 1 decrease New Sample = sample weight $\times e^{-a}$ mount of say Weight

| | | | | | | | | 150 | | 1,1 | |
|-------------|---------------------|-------------------|------------------|------------------|---------------|-----------------|----------|--------------------------|-----------------------------|-------------------|------------------|
| | | | | | | ĺ | nort | nall i | 50 f | Nn' | 10 |
| iest ain | Blocked Arteries | Patient Weight | Heart Disease | Sample Weight | New Weight | Norm. Weight | (| nalize veijht they | add | W | $\sum_{i=1}^{n}$ |
| Yes | Yes | 205 | Yes | 1/8 | 0.05 | 0.07 | | sher | $\mathcal{N}_{\mathcal{O}}$ | / | / |
| No | Yes | 180 | Yes | 1/8 | 0.05 | 0.07 | | /· / | | | |
| Yes | No | 210 | Yes | 1/8 | 0.05 | 0.07 | | | | | |
| Yes | Yes | 167 | Yes | 1/8 | 0.33 | 0.49 | | | | | |
| No | Yes | 156 | No | 1/8 | 0.05 | 0.07 | | | | / | |
| No | Yes | 125 | No | 1/8 | 0.05 | 0.07 | | | / | | |
| Yes | No | 168 | No | 1/8 | 0.05 | 0.07 | ~ | | _/_ | | |
| Yes | Yes | 172 | No | 1/8 | 0.05 | 0.07 | and | | | scht | 5 like |
| | | | | | MONE | Neve | to envor | 5. | sampla | | |
| | | | | | • | | ardi | Chest Pain | Blocked Arteries | Patient Weight | Heart Disease |
| | | | | | | (| 000 | No | Yes | 156 | No |
| | | | | | | . Ar | | Yes | Yes | 167 | Yes |
| | | | all | rate | betu | N ^V | | No | Yes | 125 | No |
| | | wl | ye | "open | | | | Yes | Yes | 167 | Yes |
|) | ther | | $\sim r^{\iota}$ | | | | | Yes | Yes | 167 | Yes |
| | | CV0V | | | | | | N/s - | Ver | 170 | Nie |
| | - (l | $(\sim$ | | | | | | Yes | Yes | 172 | No |
| | -{ b | (~~ | | | | | | Yes | Yes | 205 | Yes |
| | -{ b | (~~ | | | | | ard | | | | |

| | Blocked Patien Arteries Weight | | Sample Weight | Heart Disease | Patient Weight | Blocked Arteries | Chest Pain | Sample Weight | Heart Disease | Patient Weight | Blocked Arteries | Chest Pain |
|---|-----------------------------------|---|------------------|------------------|-------------------|---------------------|---------------|------------------|------------------|-------------------|---------------------|---------------|
| | | 0,14 | 0.07 | Yes | 205 180 | Yes | Yes | 0.07 | Yes | 205 | Yes | Yes |
| | | ~ | 0.07 | Yes | 210 | No | Yes | 0.07 | Yes | 180 | Yes | No |
| | | and if the number is between 0.14 and 0.2 | 0.49 | Yes | 167 | Yes | Yes | 7 | | | | |
| | 1), then we | (0.14 + 0.07 = 0.21), ther | 0.07 | No | 156 | Yes | No | 0.07 | Yes | 210 | No | Yes |
| | | would put this sample int new collection of sample | 0.07 | No | 125 | Yes | No Yes | 0.49 | Yes | 167 | Yes | Yes |
| | | | 0.07 | No | 172 | Yes | Yes | 0.07 | No | 156 | Yes | No |
| | | | | | | | | 0.07 | No | 125 | Yes | No |
| | | | | <u> </u> | | A | | 0.07 | No | 168 | No | Yes |
| 1 | 0177 | 0170 0177 | | oll | v7 | 2 0 | | 0.07 | No | 172 | Yes | Yes |

according to number lies in which range, us add corresponding obs to the new collection #ofors in new collection = n. * ON Blocked Heart Chest Patient Sample Chest Blocked Patient Heart Arteries Weight Disease Weight Pain Arteries Weight Disease Pain No Yes 156 No 167 Yes Yes Yes Yes 125 No Yes No No 167 Yes Yes Yes Yes Yes 167 Yes No Yes Yes 167 Yes ¹²⁵ Ultimately, this sample was Yes Yes 172 No added to the new collection Yes Yes 205 Yes of samples 4 times, 172 reflecting its larger Sample Yes Yes 167 Yes Weight. of Now we give new equal weight to then Chest Blocked Patient Heart Sample Pain Weight Disease Weight Arteries No Yes 156 No 1/8 Yes Yes 167 Yes 1/8 No Yes 125 No 1/8 Yes Yes 167 Yes 1/8 Yes Yes 167 Yes 1/8 Yes Yes 172 No 1/8 Yes Yes 205 Yes 1/8 167 1/8 Yes Yes Yes

(B) then we repeat the overall process above Prediction lqj Ultimately, the patient is classified as Has Heart Disease because this is the larger sum. **Does Not Have** Total = 1.23 Has Heart Disease Total = 2.7 Heart Disease Amount of Say Amount of Say 0.97 0.41 < 0.32 0.82 0.78 0.63 3) Each stump is made by taking Adaboast Summary the previous stump's mistakes into account. 1) AdaBoost combines a lot of "weak learners" to make classifications. The weak learners e say in are almost aways stumps. others. 2) Some stumps get more say in the classification than others.

Adaboost -> classification. adaboost 6BM: gradient Bosting Machine. gbm 2. regression regression math behind y videos on classification stat Quest plassification moth ye commended by hocam. Or Youtube. gbm i gradient bosting machine for repression ADA Boost 2 DT Random forest

In RF, each tree has the same amount of say. On Adaboost (ADA) ADB trees have different say.