

Chapter 7

1. If you have trained five different models on the exact same training data, and they all achieve 95% precision, is there any chance that you can combine these models to get better results? If so, how? If not, why?
 - a. Yes, it is possible to combine these models to get better results using a voting ensemble.
2. What is the difference between hard and soft voting classifiers?

Hard voting classifiers	Soft voting classifiers
Counts votes for classifiers and picks the one with the largest number of votes.	Calculates the probability for each class and picks the one with the highest probability.

3. Is it possible to speed up training of a bagging ensemble by distributing it across multiple servers? What about pasting ensembles, boosting ensembles, Random Forests, or stacking ensembles?

Bagging ensembles	Yes
Pasting ensemble	Yes
Boosting ensembles	No, because training must happen sequentially.
Random Forests	Yes
Stacking ensembles	No, because layers depend on each other.

4. What is the benefit of out-of-bag evaluation?
 - a. You do not need an extra validation set. Out-of-bag evaluation is relatively unbiased.
5. What makes Extra-Trees more random than regular Random Forests? How can this extra randomness help? Are Extra-Trees slower or faster than regular Random Forests?
 - a. The randomness associated with Extra-Trees allows them to perform what is essentially regularization. This generally allows Extra-Trees to perform better. However, they are not faster or slower than regular Random Forests.
6. If your AdaBoost ensemble underfits the training data, which hyperparameters should you tweak and how?
 - a. There are three hyperparameters that can be tweaked in this scenario. The first is the regularization hyperparameter which could be reduced. Next, you could increase the learning rate. Finally, if that does not work, you can increase the number of estimators.
7. If your Gradient Boosting ensemble overfits the training set, should you increase or decrease the learning rate?
 - a. You should decrease the learning rate.