

# Voting Ensemble – Regression (Part 3)

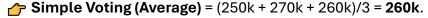
#### 1. Core Idea

- Just like classification, we can combine multiple regression models.
- Instead of voting for classes, we average the predictions of regressors.
- Goal: Reduce error by balancing the weaknesses of individual models.

#### 2. How It Works

Suppose we want to predict house prices.

- Model A (Linear Regression) predicts: 250k
- Model B (Decision Tree Regressor) predicts: 270k
- Model C (Random Forest) predicts: 260k



So, the final prediction is the **mean** of all model predictions.

#### 3. Types of Voting in Regression

Unlike classification (hard vs soft), regression has:

- 1. Simple Averaging
  - 1. Each regressor's prediction is equally weighted.
  - 2. Formula:

$$\hat{y} = \frac{1}{n} \sum_{i=1}^{n} \hat{y}_i$$

- 2. Weighted Averaging
  - 1. Some models perform better, so we give them higher weight.
  - 2. Formula:

$$\hat{y} = \frac{\sum_{i=1}^n w_i \cdot \hat{y}_i}{\sum_{i=1}^n w_i}$$

3. **Example:** If Random Forest is stronger, weight it more.

## 4. When to Use Voting Regressor?

- Works well when:
  - Models are **diverse** (e.g., linear + tree-based + ensemble).

- Each model captures different parts of the pattern.
- ❖ Be careful:
  - If all models are **weak** → averaging won't help much.
  - If one model is much better than others → use weighted averaging.

## 5. Intuition (Easy Analogy)

Imagine you want to guess someone's age from a photo:

- Person A (Linear thinker) says: 25.
- Person B (Tree thinker) says: 30.
- Person C (Random guesser but usually good) says: 28.

Final guess = average = 27.6 → usually closer to the truth than relying on a single person.

### √ Final Takeaway:

- Voting in regression = averaging predictions.
- Simple averaging = all models equal.
- Weighted averaging = stronger models get more say.
- It reduces variance, increases robustness, and usually improves performance.