ENSEMBLE LEARNING

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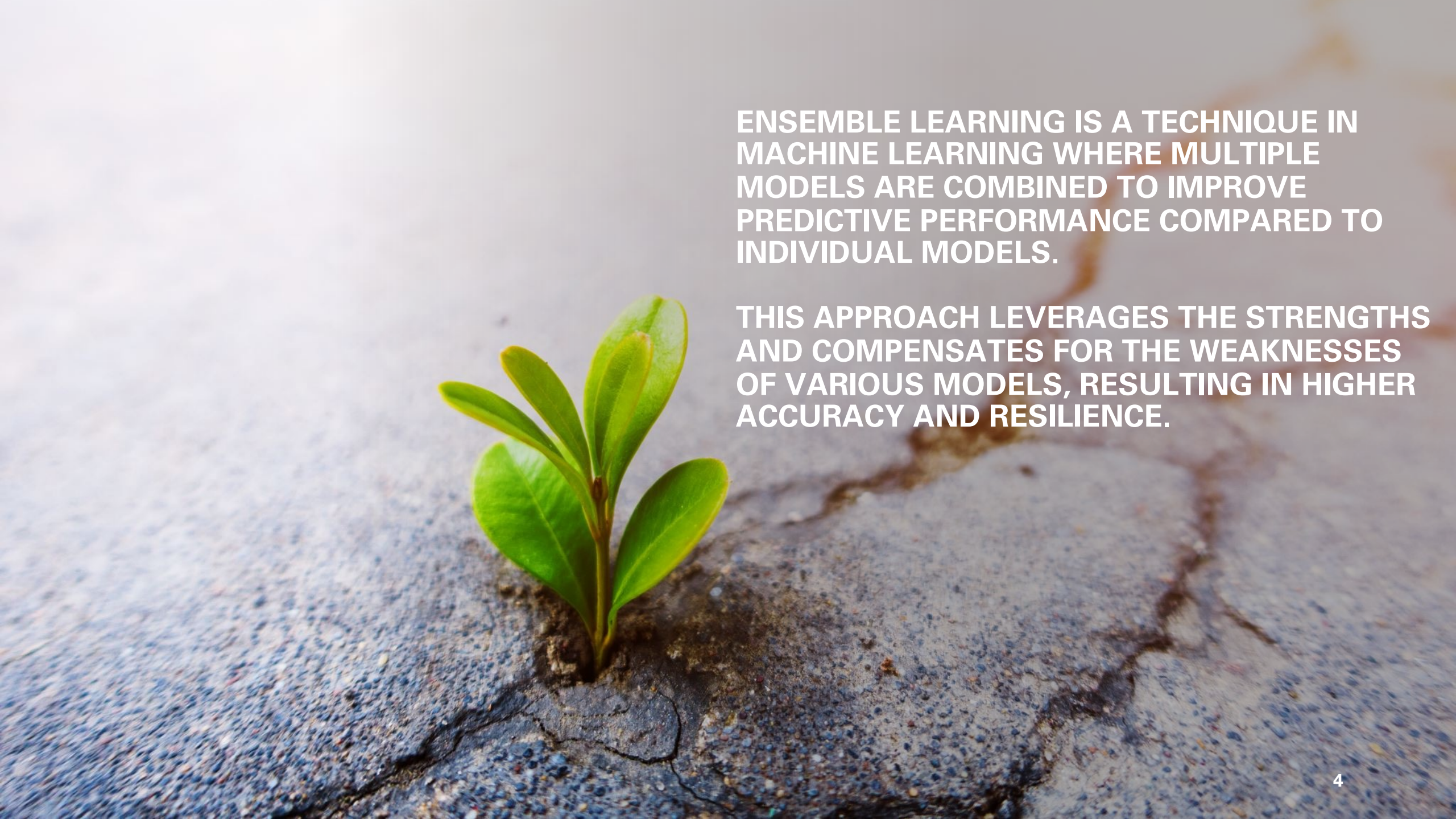
- What is ensemble learning?
- Type of ensemble learning
- Comparison
- Further reading

WHAT IS ENSEMBLE LEARNING?



ENSEMBLE LEARNING IS A TECHNIQUE IN MACHINE LEARNING WHERE MULTIPLE MODELS ARE COMBINED TO IMPROVE PREDICTIVE PERFORMANCE COMPARED TO INDIVIDUAL MODELS.

THIS APPROACH LEVERAGES THE STRENGTHS AND COMPENSATES FOR THE WEAKNESSES OF VARIOUS MODELS, RESULTING IN HIGHER ACCURACY AND RESILIENCE.

Type of ensemble learning

Bagging

Boosting

Stacking

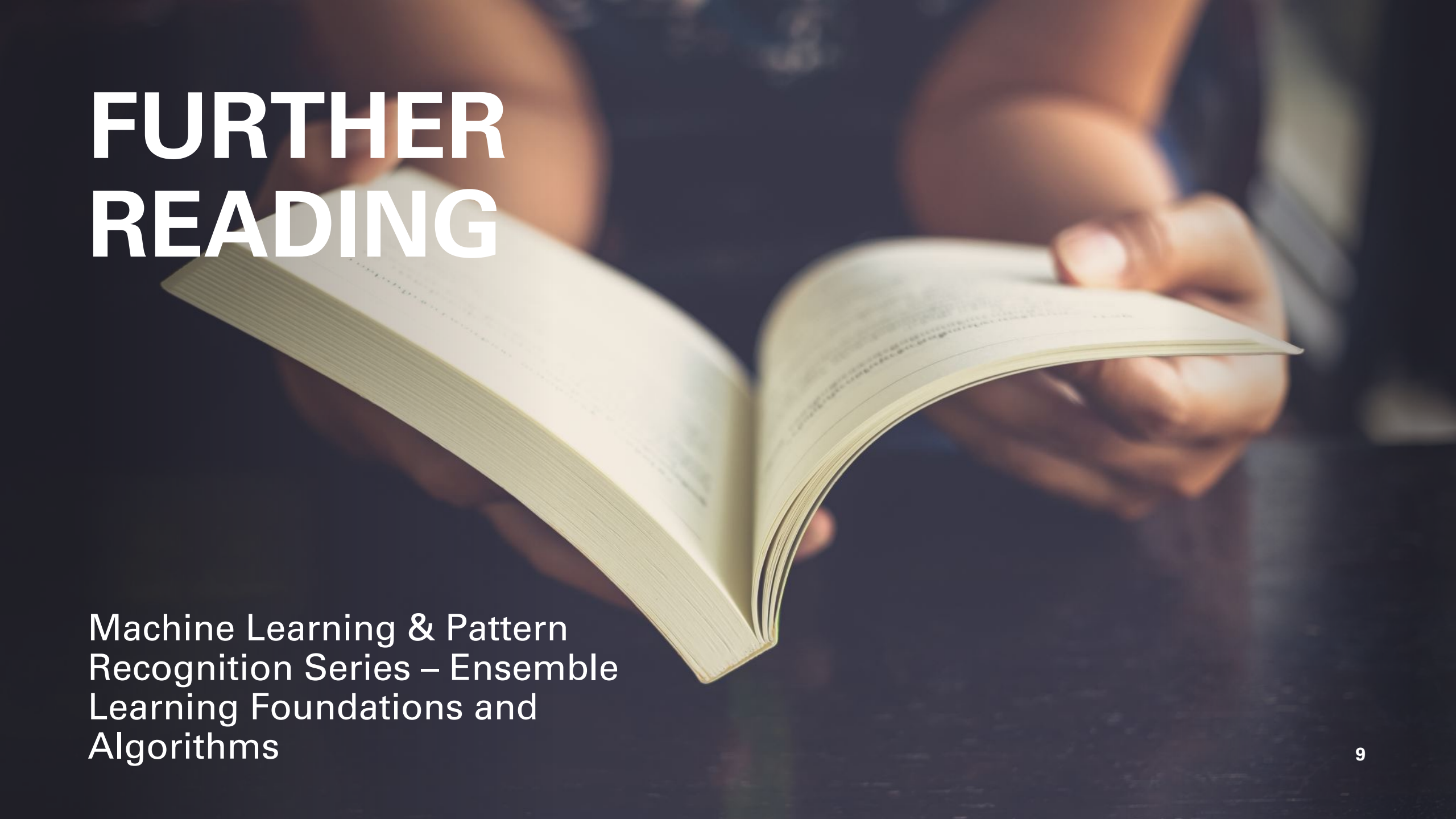
COMPARISON

Comparison

	Bagging	Boosting	Stacking
Purpose	Reduce variance	Reduce bias	Combine multiple models to improve predictive performance
Combination method	Averaging or voting	Weighted voting	Meta-learner (stacker) combines predictions of base models
Performance	Improves stability and accuracy by averaging out noise	Improves accuracy by focusing on difficult-to-predict instances	Often outperforms individual models by leveraging their strengths
Model training	Trains models independently	Trains models sequentially, each focusing on errors of the previous	Trains models independently first, then trains a meta-learner on their predictions
Handling noise	More robust to noisy data	Sensitive to noisy data and outliers	Can mitigate overfitting by using a diverse set of base models

Comparison

	Bagging	Boosting	Stacking
Complexity	- Easier to implement - simpler computation	- More complex implementation - higher computational cost	- Most complex to implement - requires careful selection - training of base models and meta-learner
Overfitting	Less prone to overfitting	Can overfit, especially with noisy data	Prone to overfitting if base models or meta-learner are not properly regularized
Weak learners	Can use any models as base learners, including strong and weak learners	Uses weak learners and iteratively improves them	Can use any models as base learners, including strong and weak learners
Hyperparameters tuning	Requires tuning of fewer hyperparameters	Requires careful tuning of hyperparameters	Requires tuning of both base models and the meta-learner



FURTHER READING

Machine Learning & Pattern Recognition Series – Ensemble Learning Foundations and Algorithms

THANK YOU