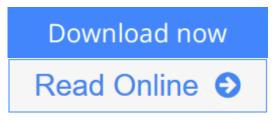# Ensemble Methods in Data Mining: Improving Accuracy Through Combining Predictions (Synthesis Lectures on Data Mining and Knowledge Discovery)

By Giovanni Seni, John Elder

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Ensemble methods have been called the most influential development in Data Mining and Machine Learning in the past decade. They combine multiple models into one usually more accurate than the best of its components. Ensembles can provide a critical boost to industrial challenges -- from investment timing to drug discovery, and fraud detection to recommendation systems -- where predictive accuracy is more vital than model interpretability.

Ensembles are useful with all modeling algorithms, but this book focuses on decision trees to explain them most clearly. After describing trees and their strengths and weaknesses, the authors provide an overview of regularization -- today understood to be a key reason for the superior performance of modern ensembling algorithms. The book continues with a clear description of two recent developments: Importance Sampling (IS) and Rule Ensembles (RE). IS reveals classic ensemble methods -- bagging, random forests, and boosting -- to be special cases of a single algorithm, thereby showing how to improve their accuracy and speed. REs are linear rule models derived from decision tree ensembles. They are the most interpretable version of ensembles, which is essential to applications such as credit scoring and fault diagnosis. Lastly, the authors explain the paradox of how ensembles achieve greater accuracy on new data despite their (apparently much greater) complexity.

This book is aimed at novice and advanced analytic researchers and practitioners -- especially in Engineering, Statistics, and Computer Science. Those with little exposure to ensembles will learn why and how to employ this breakthrough method, and advanced practitioners will gain insight into building even more powerful models. Throughout, snippets of code in R are provided to illustrate the algorithms described and to encourage the reader to try the techniques.

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Editorial Review

From the Inside Flap
"This book by Seni and Elder provides a timely, concise introduction to this topic. After an intuitive, highly accessible sketch of the key concerns in predictive learning, the book takes the readers through a shortcut into the heart of the popular tree-based ensemble creation strategies, and follows that with a compact yet clear presentation of the developments in the frontiers of statistics, where active attempts are being made to explain and exploit the mysteries of ensembles through conventional statistical theory and methods."

-- Tin Kam Ho, Bell Labs, Alcatel-Lucent

"The practical implementations of ensemble methods are enormous. Most current implementations of them are quite primitive and this book will definitely raise the state of the art. Giovanni Seni's thorough mastery of the cutting-edge research and John Elder's practical experience have combined to make an extremely readable and useful book."
-- Jaffray Woodriff, Quantitative Investment Management

About the Author
The authors are industry experts in data mining and machine learning who are also adjunct professors and popular speakers. Although early pioneers in discovering and using ensembles, they here distill and clarify the recent groundbreaking work of leading academics (such as Jerome Friedman) to bring the benefits of ensembles to practitioners.

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