Enhancing Property Value Accuracy with Ensemble Modeling Techniques

Will Jarvis & Jake Parkinson

IAAO | IIFI IPTI
International Property Tax Institute

GOT QUESTIONS? LET'S CHAT

# HOW MANY INTERNATIONAL SYMPOSIUMS HAVE YOU ATTENDED?

WHO WE ARE

Who We Are - Jake Parkinson

- Fee Appraiser
- 15 Years County Assessor, Utah
- IAAO Work (USPAP, U40, AI&IAAO)
- President Utah Association of Assessing Officers
- 2017 IAAO Member of the Year
- Past President Utah Chapter IAAO & Utah's Largest Fee Appraiser Association
- Live in Salt Lake City
- Father of four–Children did no inherit my love of good CODs

How I Tick….
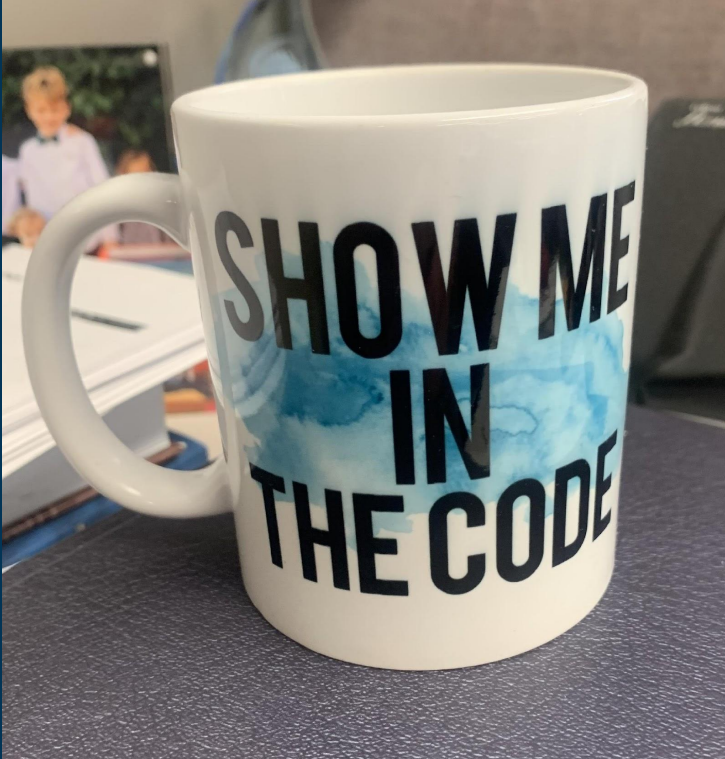
Who We Are - Will Jarvis

- Founder and CEO, Valuebase
- Former Researcher in Residence at On Deck
- Forbes 30u30
- Why Property Tax?

The Valuebase Story

- Founded in 2023
- Started as a research grant to find better ways to build better AVMs to value land and improvements
- We've raised $8mm in venture funding from:
  - Sam Altman (Open AI-ChatGPT)
  - Nat Friedman (Github)
  - Peter Thiel (Paypal)

Our Sam Story

- Our lead investor is Sam Altman, founder of OpenAI and ChatGPT
- Why invest in Valuebase?
- Sams Plan:
  - AGI -> Productivity Gains -> everyone's job gets automated away -> increase in real estate value -> **property tax** -> fund a universal basic income

The Valuebase Team

- Our CTO built models to help catch terrorists at **Palantir**.
- Our lead software engineer built wifi systems for **Delta**.
- Our Chief Architect built cloud infrastructure at **Amazon**.
- Our Chief of AVMs is on the **ratio studies standards committee**.
- Interns from Duke, Yale,

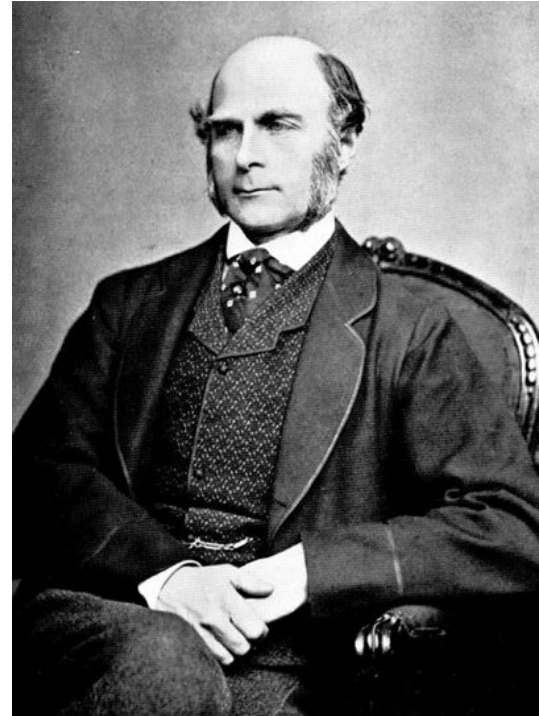**Center for Appraisal Research & Technology**

The Wisdom Of Crowds

- Who wants to be a millionaire?

The Wisdom Of Crowds - Francis Galton

- Francis Galton
  - British polymath
  - Cousin of Charles Darwin
  - Invented the concept of correlation
- Visited a farm one day…
- And discovered the wisdom of crowds

The Wisdom Of Crowds - Las Vegas Edition

The Wisdom Of Crowds - The Earliest Mass Appraisal System

- The Birth of Modern Mass Appraisal
- Invented by **W. A. Somers**, for who it was named.
- Combined "wisdom of the crowds" **public polling** to achieve accuracy, with a mechanistic algorithm.

THE SOMERS SYSTEM OF REALTY VALUATION

THE quadrennial[1] revaluation of real estate for taxation, which has been in progress in Ohio during the present year, has revived the old problems relative to proper methods of taxation, and has given rise to new ones. The pressure of the present burden of taxation[2] has led to a general demand for reforms in the existing system of valuation, under which gross inequalities have entered into the assessment of real estate, both as between different localities and as between different parcels of real estate in the same locality.[3] The popular demand everywhere has been for an enforcement of the constitutional and legal provisions requiring all property to be assessed at its fair cash value. Appraisal Boards throughout the state have been stimulated by this public outcry to greater efforts in the pursuit of their duties, and in the use of new methods of determining true valuations. One of the most elaborate of these methods is that which has been adopted in Cleveland, Ohio, the "Somers System of Realty Valuation."[4] Its essential features will here be described briefly.

Modern Wisdom of Crowds - Ensemble Modeling

- Inspired by **Luc Hermans** paper on Composite Modeling.

- We used an **ensemble approach** to modeling.

- We build out 9 different types of mass appraisal algorithms.

An exploratory approach to composite modelling for real estate assessment and accuracy
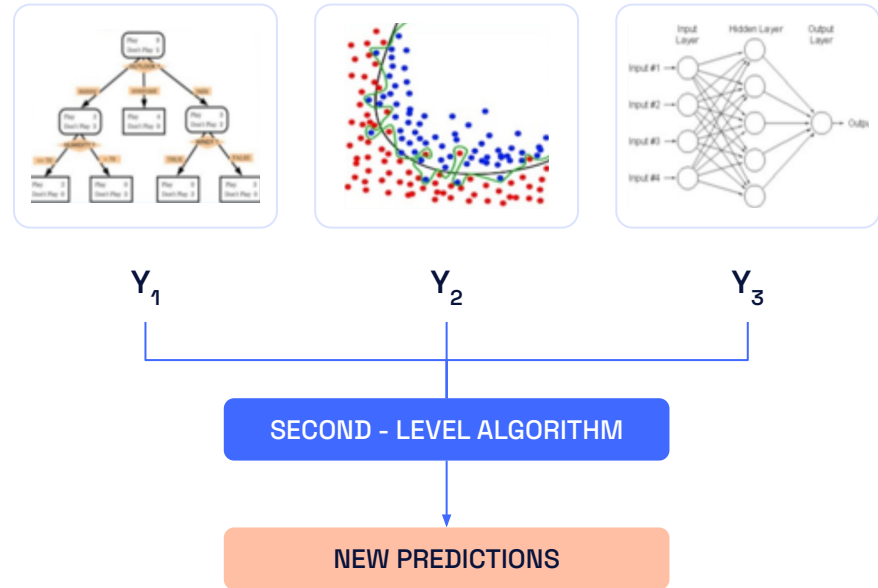
L. D. Hermans
M. J. McCord
P. T. Davis
P. E. Bidanset

Abstract

The role of automated valuation models within real estate assessment has gained in prominence over the last two decades. However, despite these developments, investigations relating to 'composite' or 'ensemble' modelling remains an under researched area. Using 28,957 properties and 5,515 usable sales transactions between 2016 and 2021 obtained from the municipality of Helmond in the Netherlands made available by the Netherlands Council for Real Estate Assessment, this paper introduces three different approaches to composite modelling: the central tendency composition approach, the weighted composition approach, and the logical coupling composition approach to enhance mass appraisal assessment, accuracy, and performance. The composition approaches developed are applied to three different automated valuation models, a traditional general linear model approach, an artificial intelligence based automated valuation model, and a geo-statistical-based automated valuation model. To identify the performance of the composition modelling approaches, a framework comprising twelve scenarios is applied to the outcomes of the composition to compare their results against the

Modern Wisdom of Crowds - Ensemble Modeling

- We build out 6-12 types of mass appraisal algorithms.
- We pick the best performing models based on ratio study results and horizontal equity testing.
- Then, we take the median of those models.

Y_1 Y_2 Y_3

SECOND - LEVEL ALGORITHM

NEW PREDICTIONS

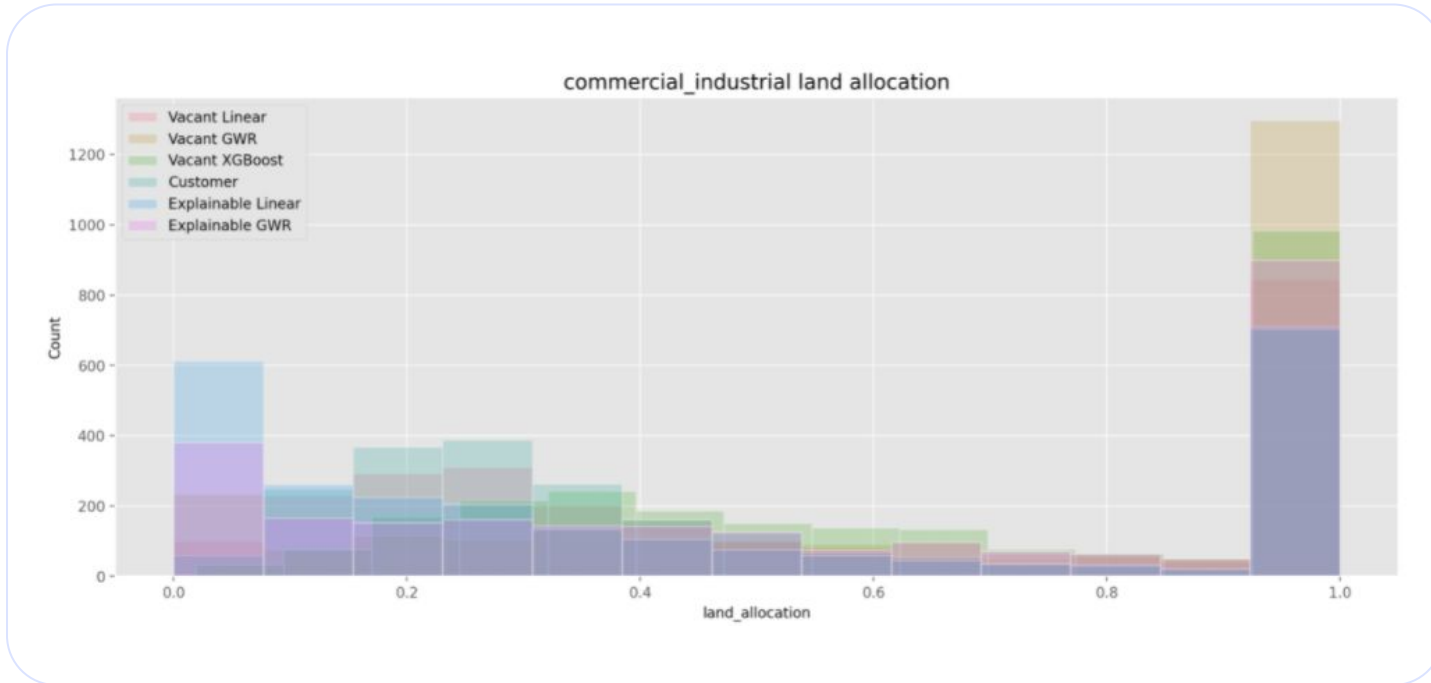IAAO   IIFI IPTI International Property Tax Institute

Modern Wisdom of Crowds - Some of the models we use in the ensemble

- Linear Models

- GWR Models

- Gradient Boosted Tree Models

- Gaussian Process Regression (Kriging)
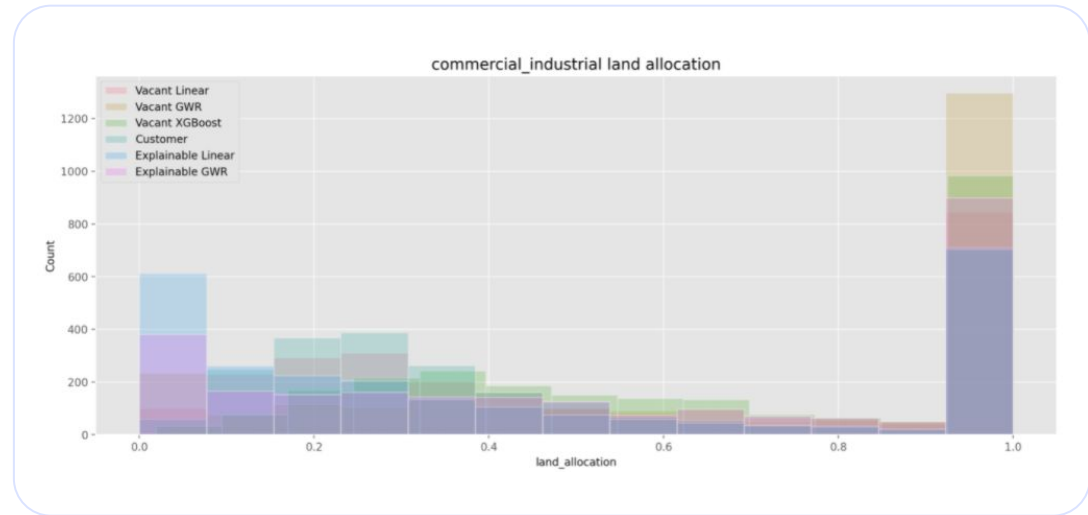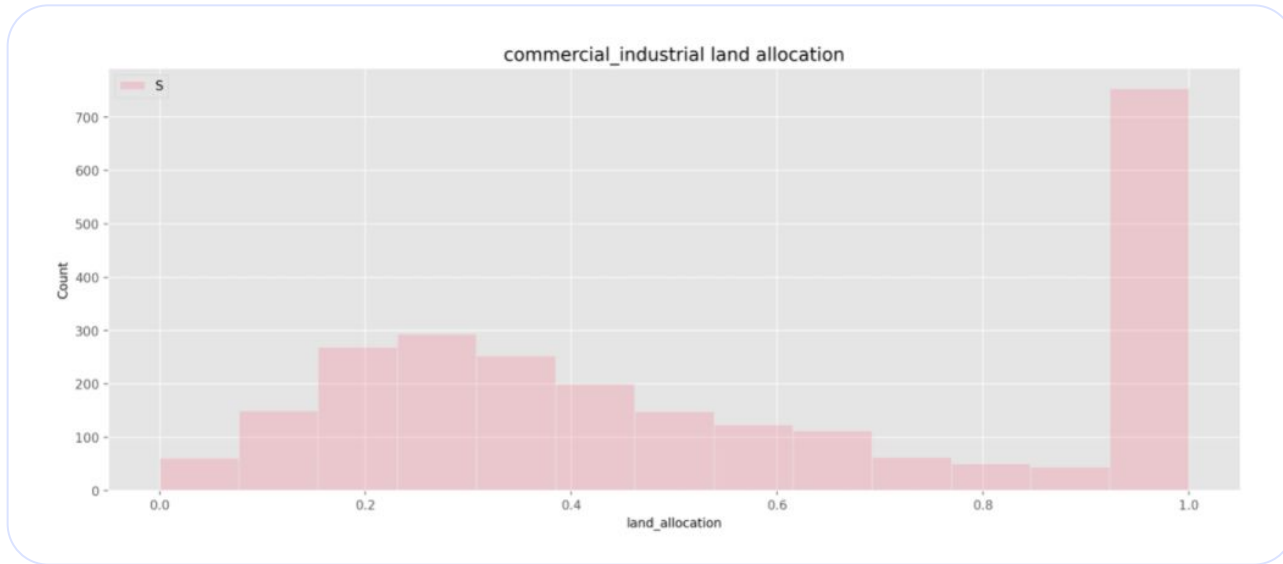

commercial_industrial land allocation

Modern Wisdom of Crowds - Wisdom of the Crowds in Action
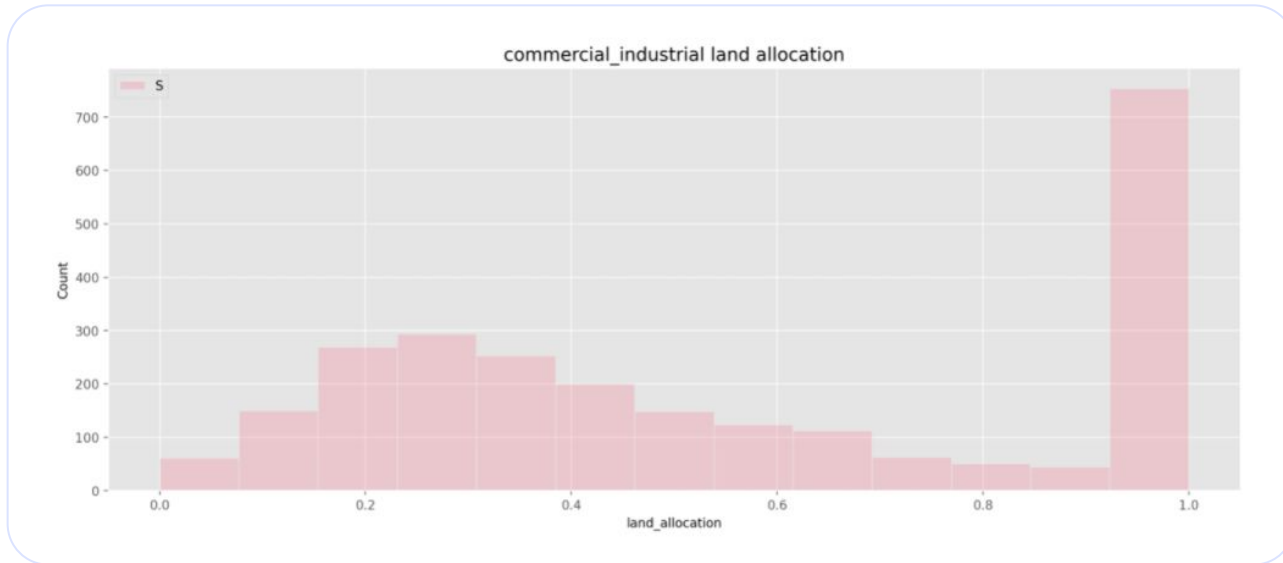
Valuebase Land allocation estimates: synthesis of all models

Modern Wisdom of Crowds - Wisdom of the Crowds in Action

Valuebase Land allocation estimates: synthesis of all models

Let's Keep in Touch

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