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OF LAND POLICY

The Potential and Challenge of Using AI in the Assessing Process

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What is AI?

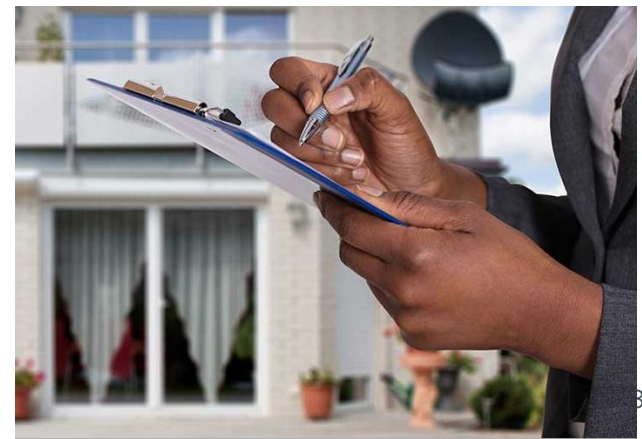
AI, or **Artificial Intelligence**, is a branch of computer science that focuses on creating systems or machines that can perform tasks that typically require human intelligence. These tasks include:

- **Understanding language** (like you and I are doing now — called *natural language processing*)
- **Recognizing patterns and images** (like facial recognition or image classification)
- **Learning from data** (*machine learning*)
- **Making decisions or solving problems** (like playing chess or navigating traffic)
- **Understanding and responding to voice commands** (like Siri or Alexa)

Source: I asked ChatGPT

Uses of AI In the Assessment Process

- Assessment Administration
 - Routing and workflow
 - Chatbot for taxpayer inquiries
- Data Collection / Quality Control
- Valuation
 - Value Source
 - Check on values from other sources



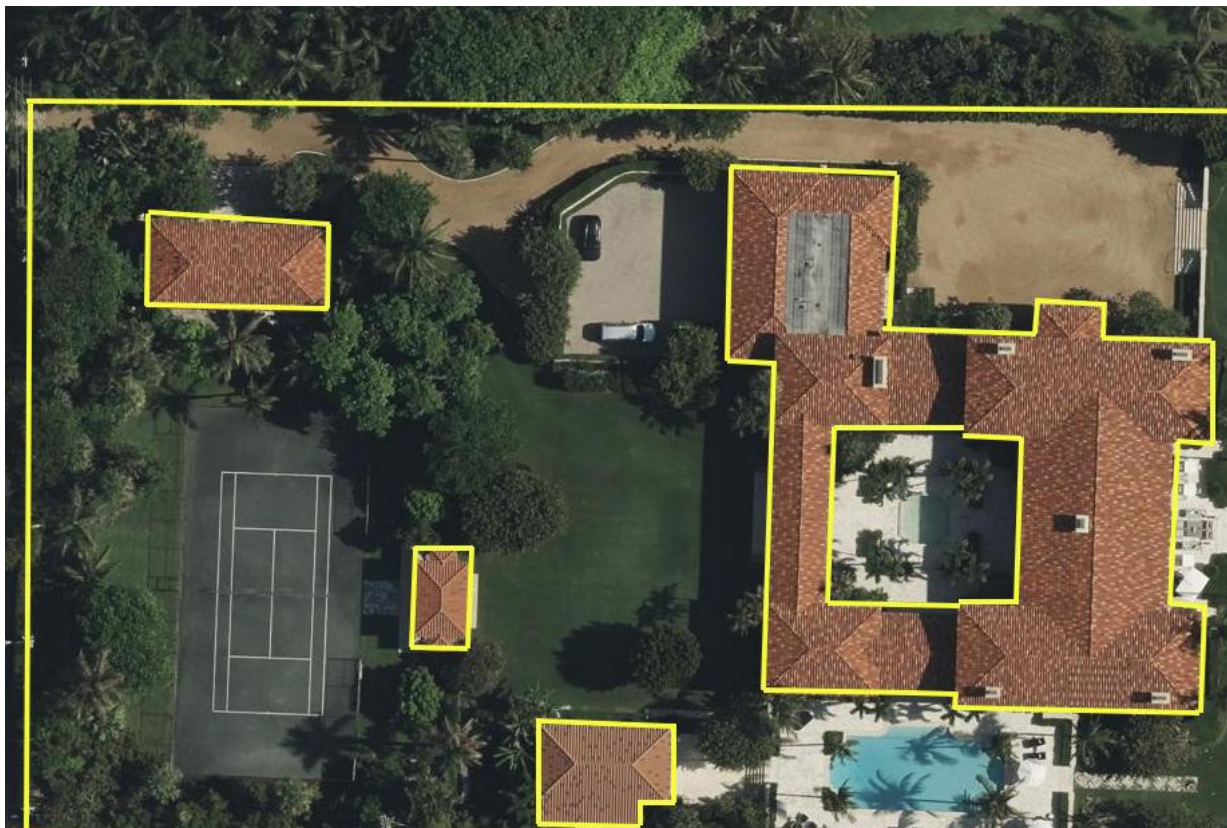
Large Language Models (LLMs) for Data Collection Used for Mass Appraisal and Property Tax Assessment

- LLMs (e.g., ChatGPT, Claude) provide a scalable way to improve completeness, standardization, and objectivity
- Data quality is the foundation of accurate and fair assessments
- Current data collection is slow, costly, and difficult to keep consistent
- Staff appraisers/experts define rules, prompts, and standards
- Staff review outputs and handle edge cases
- Human judgment remains central to final decisions
- Improved data leads to better models, fewer errors, and stronger defensibility
- Practical gains: more efficiency, less staff burden, more consistent (fair) outcomes



Data Collection – Image Recognition

AI can be used to examine aerial and street level photographs to detect property features



Building Attributes

- ✓ Footprint Area: 16,813 ft²
- ✓ Roof elevation: 52 ft
- ✓ Roof height: 30 ft
- ✗ Roof solar: No
- ✓ Roof shape: Hip
- ✓ Roof type: Tile
- ✓ Chimneys: 5
- ✓ Roof vents: 2
- ✗ AC Units: 0
- ✓ Roof condition: 4/5
- ✓ Roof discoloration: 2.64%
- ✓ Defensible Space:

Buildings: 5 ft: 0%; 30 ft: 0%; 100 ft: 6%; 200 ft: 11%

Trees: 5 ft: 14%; 30 ft: 16%; 100 ft: 31%; 200 ft: 27%

Source: Voxel Data Program

Condition Scoring



Condition = 3

Reason:

“The property appears to be in good condition, with normal wear and tear and minor repairs needed, indicating it is generally well-kept”

Confidence: high

Construction Material Grade Scoring



Quality = 2

Reason:

“The property appears to have a good design with quality materials used, such as sliding and a well-maintained landscaping, providing a nice curb appeal”

Confidence: high

Data Collection – Sales and Owner Info

- AI can also examine deed documents and extract information needed for property tax process
 - Sale price
 - Grantor/Grantee
 - Property Address
 - Etc.
- This document is from Serbia, where deeds can be filed in both Latin and Cyrillic scripts

УГОВОР О КУПОПРОДАЈИ НЕПОКРЕТНОСТИ	AGREEMENT ON SALE AND PURCHASE OF THE REAL PROPERTY
Овај Уговор о купопродаји непокретности ("Уговор") је закључен у Београду, дана 21.03.2024. године између следећих уговорних страна:	This Agreement on sale and purchase of the real property ("Agreement") is entered into in Belgrade on 21 March 2024 between the following parties:
1. Продавац: Душан Јерковић , Београд, Кнеза Милоша 111 , Србија, матични број 1111111111 , који изступа Јована Гобелјић по пуномоћју извршеном од стране јавног београдског Нотарије Андрије Адић, број УОП-Б-1430-2023 дана 12.06.2023. ("Продавац");	1. Seller : Dusan Jerkovic , Belgrade, Kneza Milosa 111 , Serbia, corporate ID Number 1111111111 , represented by Jovana Gobeljic pursuant to Power of Attorney certified before public notary Nandjija Adic, no. UOP-B-1430-2023, dated 12 June 2023 ("Seller");
и	and
2. Купац: Душан Јерковић , Трг Душана Јерковића 111 , Бајина Башка, Србија, матични број 1111111111 , ПИБ 1111111111 , који изступа Душко Нековић, ЈМБГ: 1111111111 , директор ("Купац").	2. Purchaser : Dusan Jerkovic , Trg Dusana Jerkovica 111 , Bajina Basta, Serbia, corporate ID number 1111111111 , TIN number 1111111111 , represented by Dusko Neskovic, personal ID no. 1111111111 , director ("Purchaser").
Продавац и Купац су у даљем тексту заједно означени као "Уговорне стране".	The Seller and the Purchaser shall be hereinafter jointly referred to as the "Parties".
Уводне одредбе:	Introduction:
I. Продавац је поседник грађевинског дозвола 1111111111 (Умт. бр. IX-20 бр. 1111111111), издате од Секретаријата за урбанизам и грађевинарство града Београда дана 24.03.2022. године, прописаном од 06.04.2022. године ("Грађевинска дозвола"), којом се одобрава реконструкција, доградња, промена и изградња стамбено-пословног комплекса "Депо Residence" ("Complex") и која, поред реконструкција, доградње и промене постојећих објеката како је предвиђено Грађевинском дозволом, укључује и изградњу стамбено-пословног објекта који се састоји из 3 јавели А, Б и Ц, и подzemне гараже на углу улица Булевар краља Александра и Средњег у Београду, на III. I коју чине катастарске парцеле 799/1, 799/3, 799/5 и 4926/6 Катастарског Општина Врњак у које су на основу решења Републичког геодетског завода, Службе за катастар непокретности Врњак бр. 952-02-3-228-468/2022 од 20.05.2023. године спојене у катастарску парцелу бр. 5244 Катастарског општина Врњак ("Објекат");	I. The Seller is holder of the construction permit no. 1111111111 (Umt. No. IX-20 no. 1111111111), issued by the Secretariat for Urbanism and Construction Affairs of the City of Belgrade on 24 March 2022, final as of 6 April 2022 ("Construction Permit"), approving reconstruction, addition, change of the purpose and construction of the residential-business complex "Depo Residence" ("Complex") and which, in addition to reconstructions, addition and change of the purpose of existing facilities as specified in the Construction Permit, includes development of the residential-business building comprising of 3 sections A, B and C and underground garage, at the corner of the Bulvar kralja Aleksandra and Sedzacka Streets in Belgrade, on the GP 1 composed of cadastral lots no. 799/1, 799/3, 799/5 and 4926/6 Cadastral Municipality Vrsar which have been merged in the cadastral lot no. 5244 Cadastral Municipality Vrsar on the basis of the Republic Geodetic Bureau, Cadstral Registry Department, Vrsar no. 952-02-3-228-468/2022 dated 20 May 2022 ("Building").

Where AI Still Struggles with Imagery

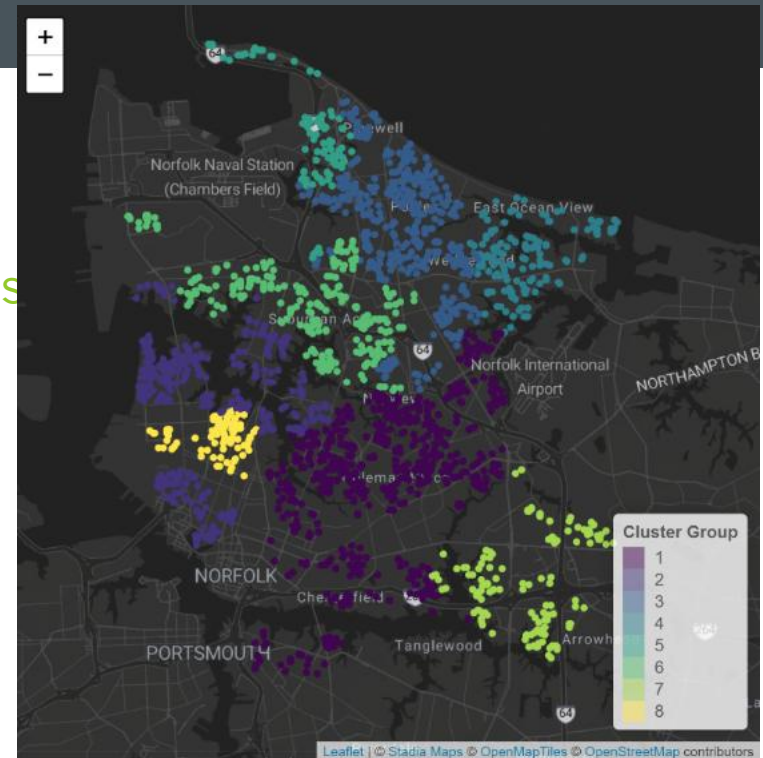
- Image quality: low resolution, blur, compression
- Lighting: shadows, glare, low light can hide or mimic features
- Obstructions: trees, vehicles, angles block visibility
- Outdated imagery: may not reflect current condition or improvements
- Look-alike features: e.g., shadows vs solar panels, sheds vs garages
- Confidence: may produce answers even when uncertain. (though can report confidence for flag)

Best Practice:

- Use as a screening tool, not final determination
- Flag uncertain cases and route for review

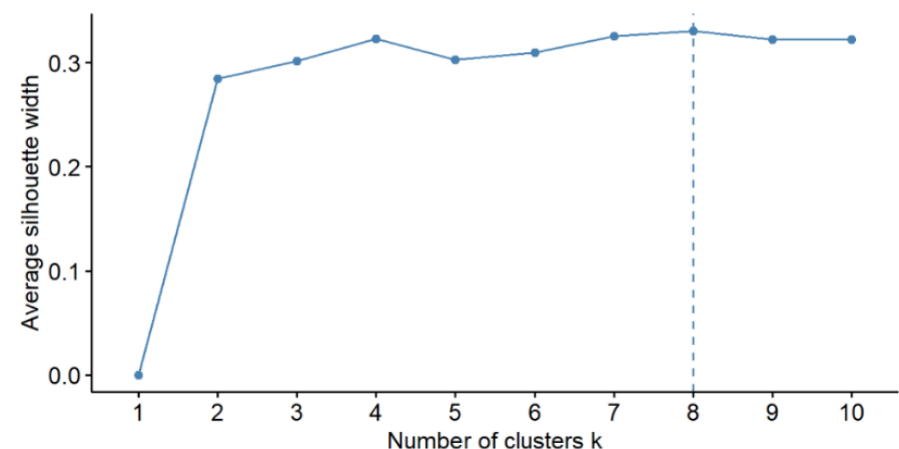
Using AI to Redraw Submarket Boundaries

- Capturing neighborhood value influences is key to producing accurate assessments
- Machine Learning (ML) algorithms (e.g., clustering) streamline baseline suggestions geographic changes in supply/demand over time
- Areas are reviewed, adjusted, and finalized/approved by expert appraisers
- New delineations help reduce inequities and promote efficiencies (data collection, valuation, review, appeals, etc).



Optimal number of clusters

Silhouette method



Tradition Valuation Approaches for Residential Properties

Cost Approach

$$\text{Property Value} = \text{Land Cost} + \text{Cost New} - \text{Accumulated Depreciation}$$

- Both are formula driven approaches
- Appraiser input is not only possible, but important to both
- Changes in data result in known changes in value (e.g., changing condition from good to excellent will add \$20 per sq. ft.)
- The model can be explained to appraisers, taxpayers, etc.

Regression

Multiple Regression Analysis				
Dependent Variable = Inpricepsfadj	Inpricepsfadj	Statistical Result		
Median ratio	0.9938			
Adj R ²	0.5072			
COD	0.2016	does not satisfy LAAO		
PRD	1.0623	does not satisfy LAAO		
White test	DF	Chi-Square	Pr > ChiSq	Heteroskedastic
	273	361.8	0.0003	
Variable	Parameter Estimate	t Value	Pr > t	
Intercept	9.49223	64.18	<.0001	
lnsfla	-0.54659	-21.67	<.0001	
lnprc_frontage	0.11788	5.07	<.0001	
lnbld_depth	0.07611	3.26	0.0011	
lnraildist	-0.03677	-3.85	0.0001	
BuiltFAR	-0.15213	-7.6	<.0001	
maxfar	-0.19639	-8.14	<.0001	
maxfar2	0.03203	5.13	<.0001	
altage	0.00037495	2.16	0.0307	
gar_sqft	0.00022353	4.41	<.0001	
stories	0.07642	7.18	<.0001	
raildist	-0.00000912	-2.7	0.0069	
basement_dummy	0.12363	4.24	<.0001	
multifamily	-0.01824	-1.77	0.0772	
brick	0.03598	3.73	0.0002	
masonry_artf	0.09607	2.55	0.0109	
masonry_comb	0.0361	1.64	0.1001	
composition	-0.03629	-2.94	0.0033	
stucco	0.07006	4.45	<.0001	
wood	-0.043	-1.75	0.0796	
attached	-0.02468	-2.04	0.0413	
row	-0.07871	-4.99	<.0001	
conventional	-0.09265	-3.96	<.0001	
old_style	-0.03322	-2.15	0.0312	

Using AI to Generate Assessed Values

Implications of AI values

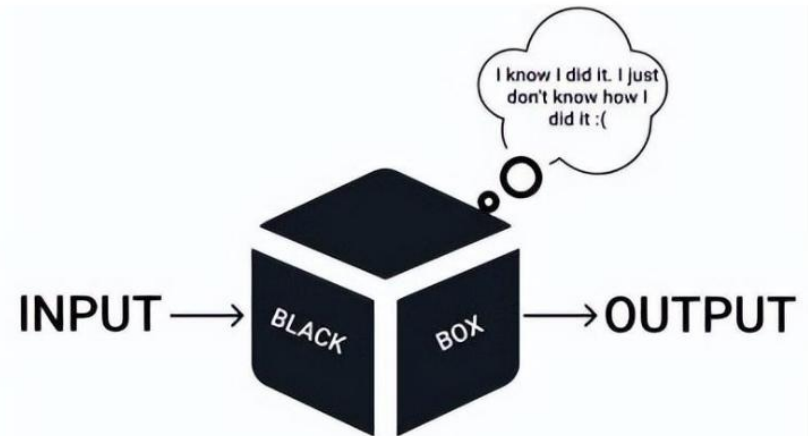
- Process-driven - no model or equation.
- Geared to maximize predictive accuracy (not explainability).
- Appraiser input not possible
- Need alternative methods to explain and support results.

Who is using AI to value property?

- A few large jurisdictions are using AI to value residential properties
- Several vendors are offering AI valuation services
- No small jurisdictions are using AI models (so far)

AI Methods

- Classification and Regression Trees (CART)
- Random forests
- Neural networks
- Gradient Boosting Methods (GBM)



Accuracy

AI / Machine Learning



MRA / Regression



Cost Approach



Harder to Explain

Explainability

Easier to Explain

Is the "Black Box" a deal breaker for AI valuation models

Point

- Property tax assessments are different than other AI applications because explainability is critical.
- Few jurisdictions have a data scientist or technical staff to run AI models

Counterpoint

- Assessors explain assessments with comps, not formulas – this can be done for AI
- We trust AI in Waze to get us home – why can't we trust it to value property?
- If AI isn't appropriate as a primary value source, it can support primary valuation methods – e.g., comp selection, time adjustments, QC on other value sources
- True. But AI often works best with large datasets. What if a state-level AI model could be created and the expense shared among jurisdictions?

Using AI to Generate Assessed Values

- Another approach is to use AI generated valuations as another opinion of value to compare with the assessor's primary model and cost approach values.
- A more practical role for AI is improving the individual components that go into valuation.
 - Property characteristics
 - Classifications (condition, quality, etc.)
 - Location patterns/drivers in the market



IAAO AI Task Force Study on AI Valuation Models

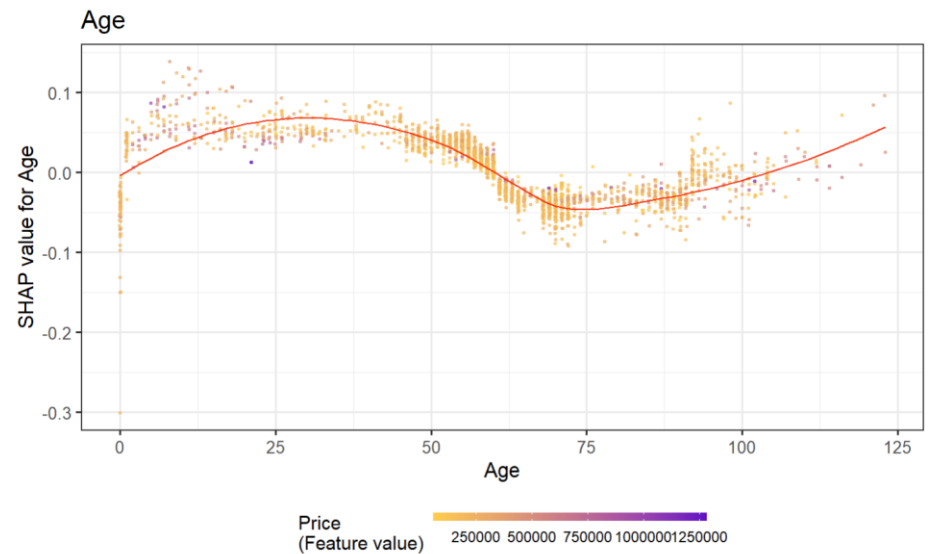
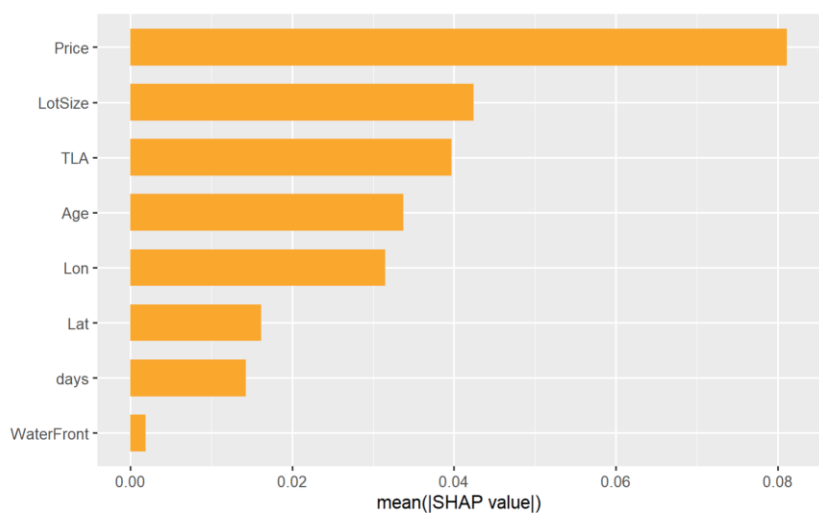
- Used datasets from Adams County (US), Belfast (UK) and Eindhoven (NL)
- Study compared the performance of traditional linear regression approaches with various AI techniques
- Results were judged using ratio study metrics from IAAO (e.g., COD, PRD, PRB) and other statistical measures for model performance.

“The findings reveal that ensemble machine learning models consistently outperform traditional regression methods across all the jurisdictions examined, exhibiting superior accuracy, precision and equity...”



AI for Suggesting Inequity Sources

- E.G. SHAPValues
 - Decomposing black box models to ID potential inequity sources



AI for Customer Service

- Chatbots to help taxpayers navigate websites, understand tax bills, answer questions, direct inquiries, etc.
- Videos to explain in different languages (e.g. San Joaquin County, CA)
- Frees up clerical and appraisal staff to work on other office tasks



Concluding Thoughts

- AI is not revolutionizing all assessment offices, but it is helping many do their jobs better
- Most uses today improve data, efficiency, market analysis, and existing valuation methods.
- Better data can mean fewer errors, lower costs, and fairer assessments.
- More complex models can be harder to explain and defend.
- Adoption will vary widely based on budgets, staff, data, and resources – assessment offices are generally slow to learn, adopt, and implement new technology.
- Some assessment offices will have access to tools that others simply cannot afford.

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