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Imagining the algorithmic city: bias, cultural authenticity, and spatial futures in AI-generated representations of Indonesian urban environments

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ABSTRACT

Background: Generative artificial intelligence increasingly mediates how Indonesian cities are visualized, yet its synthetic urban imagery may privilege iconic infrastructure and global metropolitan aesthetics while weakening social, linguistic, and cultural complexity. **Objective:** This study examines how algorithmic bias, cultural authenticity, and spatial futurity are constructed across AI-generated representations of Jakarta, Surabaya–Madura, Bandung, Yogyakarta, and national urban futures. **Method:** A comparative qualitative multimodal design analyzes twelve static AI-generated images, supported by secondary scholarship and official contextual documents, through spatial representation auditing, a cultural-authenticity and semiotic-specificity matrix, and spatial-futures narrative analysis. **Results:** Findings show that skylines, monuments, bridges, and engineered environments provide strong geographical recognizability, whereas informal spaces and socially differentiated actors remain comparatively marginal. Cultural identity is retained primarily through landmarks and religious architecture, but vernacular forms, linguistic signage, and everyday practices receive substantially less visibility. **Implication:** Future orientation is expressed mainly through technological order, polished infrastructure, and globally legible urban form, while ecological complexity and social inclusion remain limited. **Novelty:** This study contributes an integrated analytical framework demonstrating that representational bias may operate through selective preservation rather than complete cultural erasure, thereby connecting urban visual analysis, cultural semiotics, and critical AI urbanism within a comparative Indonesian context and offering a transferable approach for evaluating synthetic cities.

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1. INTRODUCTION

Indonesia's urban future is increasingly mediated through computational images rather than encountered only through planning documents, maps, or physical travel. This shift matters in a country whose population reached approximately 285.7 million in 2025, while 73% of residents used the internet in 2024, enlarging the audience for synthetic visual culture. Jakarta was identified by the United Nations' 2025 urbanization revision as the world's largest urban agglomeration, with nearly 42 million inhabitants, while Nusantara is officially designed around eight principles that include more than 75% green open space, universal accessibility, and technological efficiency. These figures reveal a tension between demographic complexity and digitally compressed urban imagery. Generative systems can circulate polished skylines,

monumental infrastructure, and futuristic ecologies at scales that may influence tourism, design expectations, investment narratives, and public understandings of place. When such systems render Indonesian cities, representational selection therefore becomes an urban knowledge problem, not merely an aesthetic choice.

Existing scholarship has established several foundations for examining this problem in contemporary urban research. Research on algorithmic bias shows that computational models can reproduce unequal classifications and systematically privilege dominant patterns (Akter et al., 2022), while studies of cultural heritage and generative AI identify risks of omission, stereotyping, and decontextualization (Foka & Griffin, 2024; Karpouzis, 2024). Urban-image research has examined street-view coverage, spatial perception, and AI-assisted interpretation of built environments (Cinnamon, 2024; Fan et al., 2024; Zhang et al., 2024). More recent work demonstrates that generative systems may flatten architectural diversity, display geographic knowledge deficits, and organize future-city narratives around recurring technological forms (Campo-Ruiz, 2025; Beneduce et al., 2025; Cao et al., 2025; Lazzeroni & Romano, 2025). Yet limited attention has been given to how Indonesian urban environments are visually reconstructed across multiple cities, or how bias, cultural authenticity, and spatial futurity interact within the same comparative corpus across Indonesia.

This study addresses that gap by examining AI-generated images and videos representing Jakarta, Surabaya–Madura, Bandung, Yogyakarta, Nusantara, and national urban futures. It asks three questions. First, which spatial forms, infrastructures, ecological elements, and social environments are made visible, marginalized, or absent when Indonesian cities are rendered through generative systems? Second, how is cultural authenticity assembled through landmarks, vernacular architecture, religious symbols, linguistic signage, everyday practices, and local–global visual hybridity? Third, what urban futures are normalized through technological solutionism, ecological imagery, mobility systems, social inclusion, and generic global-city aesthetics? These questions are investigated through a comparative spatial representation audit, a cultural authenticity and semiotic specificity matrix, and spatial futures narrative analysis. Rather than treating generated images as transparent descriptions, this study approaches them as mediated visual propositions whose selections can be compared with official urban documents, contextual evidence, and research on AI urbanism (Palmini & Cugurullo, 2023; Xu et al., 2024).

This study advances the argument that AI-generated Indonesian cities are likely to be culturally recognizable yet spatially selective: locality may be signalled through monuments, religious architecture, tropical vegetation, or branded signage while heterogeneous neighbourhoods, informal economies, ordinary mobility, and contested histories remain less visible. Such selectivity does not demonstrate intentional discrimination or identify a training-data mechanism; instead, it provides a testable account of how representational bias operates through patterned emphasis and omission. This study further proposes that cultural authenticity should not be measured as fidelity to a single, pure Indonesian identity, but as the relational depth connecting architecture, language, social practice, history, and place-specific environments. Future-city imagery is expected to reveal tension between territorially grounded visions—such as Nusantara's forest, sponge, and smart-city principles—and interchangeable imaginaries of glass towers, frictionless mobility, and automated governance. Examining this tension clarifies how generative AI participates in negotiating whose city becomes visible, credible, and collectively imaginable.

2. LITERATURE REVIEW

2.1. Algorithmic bias

Algorithmic bias refers to distortions through which computational systems privilege some representations while disadvantaging others. In accounts, bias is often treated as a property of data, labels, model architecture, or evaluation procedures; in critical urban research, however, it concerns whose spaces become legible, comparable, and governable. Akter et al. (2022) [1] emphasize discriminatory outcomes in machine-learning systems, whereas Hou et al. (2024) [2] and Liu et al. (2023) [3] show how spatial models can transfer or conceal inequalities through geographic proxies and opaque inference. Fan et al. (2025) [4] similarly demonstrate that image coverage itself is uneven. Bias therefore operates representationally, not only statistically.

For imagery, algorithmic bias can be examined through selection, omission, hierarchy, and repetition. Selection concerns which buildings, infrastructures, landscapes, and populations appear; omission identifies absent informal settlements, peripheral zones, or everyday practices. Hierarchy addresses compositional prominence, while repetition reveals skyline, monument, and smart-city tropes. Cinnamon (2024) [5] shows that imaging technologies can render informal settlements selectively visible, while Zhang et al. (2023) [6] distinguish mapped urban functions from subjective perception. Zhang et al. (2024) [7], Dai et al. (2024) [8], and Yang et al. (2024) [9] further demonstrate that urban visual analytics depends on framing, coverage, and perceptual criteria. These dimensions guide a representational audit.

2.2. Cultural authenticity

Cultural authenticity concerns whether representations sustain meaningful relations among place, history, social practice, language, and material form. One approach treats authenticity as visual accuracy or recognizability; another understands it as socially negotiated, historically situated, and vulnerable to essentialism. Foka and Griffin (2024) [10] warn that generative AI may reproduce cultural exclusions, while Karpouzis (2024) [11] frames synthetic imagery as mediated cultural projection rather than neutral reflection. Campo-Ruiz (2025) [12] shows that generative systems can flatten architectural diversity across cultural contexts. In Indonesian cities, authenticity therefore cannot mean fidelity to a singular national essence; it must address place-specific difference, hybridity, and contested cultural ownership.

Operationally, cultural authenticity can be assessed through landmark specificity, vernacular architecture, religious and commemorative symbolism, linguistic signage, everyday activity, and local-global hybridity. Landmark specificity tests recognizability but cannot alone establish cultural depth. Vernacular form evaluates climate, material, and regional design, while signage reveals which languages and institutions occupy public visibility. Aini (2026) [13] emphasizes ethnolinguistic signage in multicultural neighborhoods, Sartono (2026) [14] links street art to urban visual discourse, and Daroji (2026) [15] examines architectural narratives as spatial language. Hidayat (2026) [16] further shows how tourism imagery can exoticize place. Authenticity thus requires sustained relational density rather than merely decorative tokens or isolated icons.

2.3. Spatial futures

Spatial futures refer to narratives and images through which urban worlds are anticipated, normalized, or contested. Planning scholarship often treats future scenarios as decision-support instruments, whereas critical AI urbanism examines how technological imaginaries narrow what counts as desirable progress. Palmini and Cugurullo (2023) [17] conceptualize AI urbanism through its spatial implications, while Allam et al. (2022) [19] and Bibri and Allam (2022) [18] connect virtual cities to datafication, platformization, and sustainability. Batty (2024) [20] and Xu et al. (2024) [21] focus on digital twins and generative urban scenarios. These approaches differ over whether computational futures expand planning capacity or consolidate technocratic visions of urban order.

Spatial futures can be analysed through temporality, technological solutionism, ecological futurity, mobility, inclusion, and aesthetic homogenization. Cao et al. (2025) [23] examine how future cities imagined by ChatGPT-4o are evaluated, while Lazzeroni and Romano (2025) [22] identify narrative structures in AI-mediated urban visions. Beneduce et al. (2025) [24] foreground geographic knowledge deficits, and Bibri et al. (2024) [25] connect AI–digital-twin systems with sustainable planning. Yet sustainability imagery may remain superficial when social distribution, informality, and cultural difference disappear. This study therefore treats generated urban futures as representational propositions whose credibility depends on spatial specificity, cultural depth, and inclusion, rather than on technological sophistication alone.

3. METHOD

This study analyses a corpus of 35 publicly verifiable items concerning AI-generated representations of Indonesian urban environments. Its material units comprise 15 primary items, including twelve static images and three videos; 12 secondary scholarly sources; and eight contextual documents from official urban institutions. Primary materials represent Jakarta, Surabaya–Madura, Bandung and its peri-urban fringe, Yogyakarta, and national future-oriented imagery, while Nusantara enters through contextual planning documents. Each item is treated as a bounded multimodal document combining visual content, title, description, source metadata, and, where relevant, frames, timestamps, and transcripts. Table 1 summarizes this corpus composition and analytical status for comparative analysis.

This study adopts a comparative qualitative multimodal design supported by coding. Such a design is appropriate because generated urban imagery does not merely depict space; it selects, orders, and normalizes spatial forms, cultural symbols, and future narratives. Comparison occurs across cities, media formats, and evidentiary classes rather than through experimental manipulation. Three analytical instruments structure interpretation: a comparative spatial representation audit, a cultural authenticity and semiotic specificity matrix, and spatial futures narrative analysis. This design permits patterned comparison while preventing unsupported causal claims about model architecture, training data, or audience effects, which cannot be established from available representational outputs alone.

Information was obtained from three differentiated source groups. Primary evidence came from publicly accessible Freepik pages explicitly labeling images as AI-generated and YouTube or YouTube Shorts pages whose titles or descriptions identified AI visions or visualizations. Secondary evidence comprised recent scholarship on algorithmic bias, urban visual intelligence, generative AI, cultural representation, and AI urbanism. Contextual evidence came from official portals and documents issued by the Nusantara Capital Authority, Surabaya municipal institutions, and Bandung's open-data platform. These source groups were not merged analytically: primary items supported representational claims, secondary

literature guided interpretation, and official documents provided place-specific contextual baselines for comparison.

Data collection followed a transparent ten-stage protocol. Searches combined city names with terms such as AI-generated, skyline, future city, bridge, architecture, signage, and visualization. Eligible items had to identify an Indonesian urban location, establish AI status, remain publicly accessible, and provide verifiable provenance. Researchers recorded titles, creators, dates, platforms, URLs, languages, locations, descriptions, visual actors, symbols, colour, layout, logos, frames, timestamps, transcripts, and screenshot references. Exact duplicates were removed through canonical URLs, while useful near-duplicate motifs were flagged rather than silently discarded. Every retained document received a unique identifier linking metadata, textual storage, visual description, and coding records across files.

Analysis proceeded through three aligned stages. First, spatial auditing coded typology, infrastructure centrality, verticality, ecological presence, informality, and social diversity, producing cross-city matrices and descriptive frequency summaries. Second, authenticity analysis examined landmark specificity, vernacular form, religious or commemorative symbols, linguistic signage, everyday practices, hybridity, and authenticity risks such as tokenism or generic substitution. Third, future-narrative analysis coded temporality, technological solutionism, ecological futurity, mobility, inclusion, global-city aesthetics, and speculative distance. Video materials were sampled at scene transitions and fixed intervals. A pilot subset was double-coded, disagreements were systematically adjudicated, and nominal or ordinal agreement measures were calculated before final interpretive synthesis.

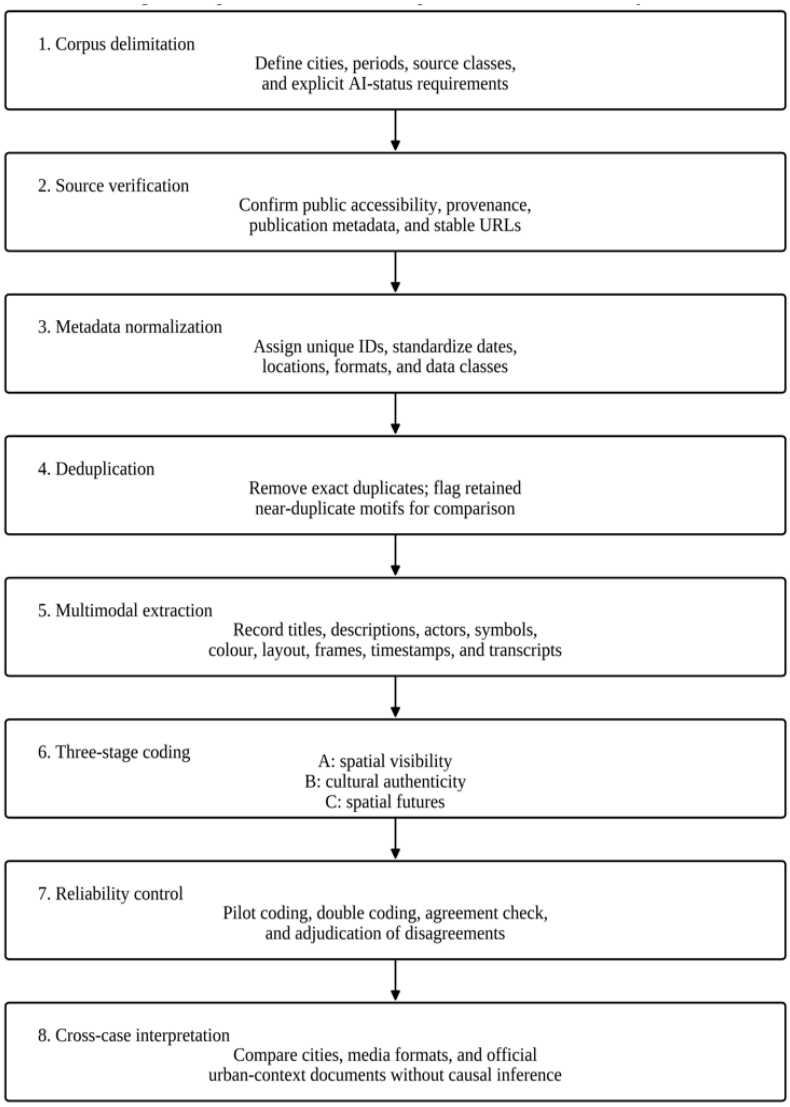

Figure 1. Operational matrix of corpus construction and analysis

Table 1. Composition of dataset

Code	Data type	Source	Location or coverage	Period	Number	Main characteristics
PRI-JKT	AI-generated images and videos	Freepik; YouTube; YouTube Shorts	Jakarta	2023–2026 or undated public items	7	Skylines, toll roads, monuments, iconic illustrations, and distant urban futures
PRI-SBY	AI-generated images	Freepik	Surabaya	2024 or undated public items	1	Night bazaar and commercial leisure environment
PRI-SBYM	AI-generated images	Freepik	Surabaya–Madura	Undated public items	2	Suramadu Bridge, connectivity, infrastructure, and coastal framing
PRI-BDG	AI-generated images	Freepik	Bandung	Undated public items	2	Monumental civic and religious architecture
PRI-BDGP	AI-generated image	Freepik	Bandung peri-urban fringe	Undated public item	1	Rice fields, aerial landscape, and urban–rural interface
PRI-YGY	AI-generated image	Freepik	Yogyakarta	2023	2	Commercial signage, minimarket branding, and nocturnal streetscape
PRI-IDN	AI-generated video	YouTube	Indonesia, unspecified cities	Approximately 2024	1	National urban future projected toward 2050
SEC	Scholarly articles and preprints	Academic journals; DOI and publisher pages	Global and Global South	2021–2026	12	Algorithmic bias, cultural representation, urban visual intelligence, and AI urbanism
CTX-IKN	Official webpages and policy documents	Nusantara Capital Authority	Nusantara	2023–2026 or undated portal material	4	Smart-city blueprint, net-zero strategy, forest-city vision, and institutional reporting
CTX-SBY	Official city, tourism, and environmental documents	Surabaya municipal institutions	Surabaya	2016–2023 or current portal	3	City identity, tourism discourse, biodiversity, and environmental planning
CTX-BDG	Official open-data portal	Bandung City Government	Bandung	Current portal	1	Place-specific indicators and municipal datasets
Total					35	15 primary, 12 secondary, and 8 contextual items

4. RESULTS

4.1. Selective urban visibility in AI-generated Indonesian cities

The visual corpus constructs Indonesian urbanity through considerable typological variation but a narrower distribution of social visibility. Eleven spatial forms were recorded across twelve images, ranging from metropolitan skylines and transport corridors to religious monuments, commercial streets, leisure spaces, and peri-urban agriculture. Such variation indicates that generated urban representation cannot be reduced to a single futuristic-city template. Nevertheless, physical form remains considerably more legible than lived social complexity. Infrastructure occupies low, medium, and high levels in equal proportions, while high verticality appears in four images and is concentrated primarily in Jakarta-related material. By contrast, informal spatial formations and differentiated social actors remain largely absent. This imbalance establishes the central descriptive pattern: AI-generated cities are spatially diverse at the level of objects and settings, yet substantially thinner when examined as socially inhabited environments.

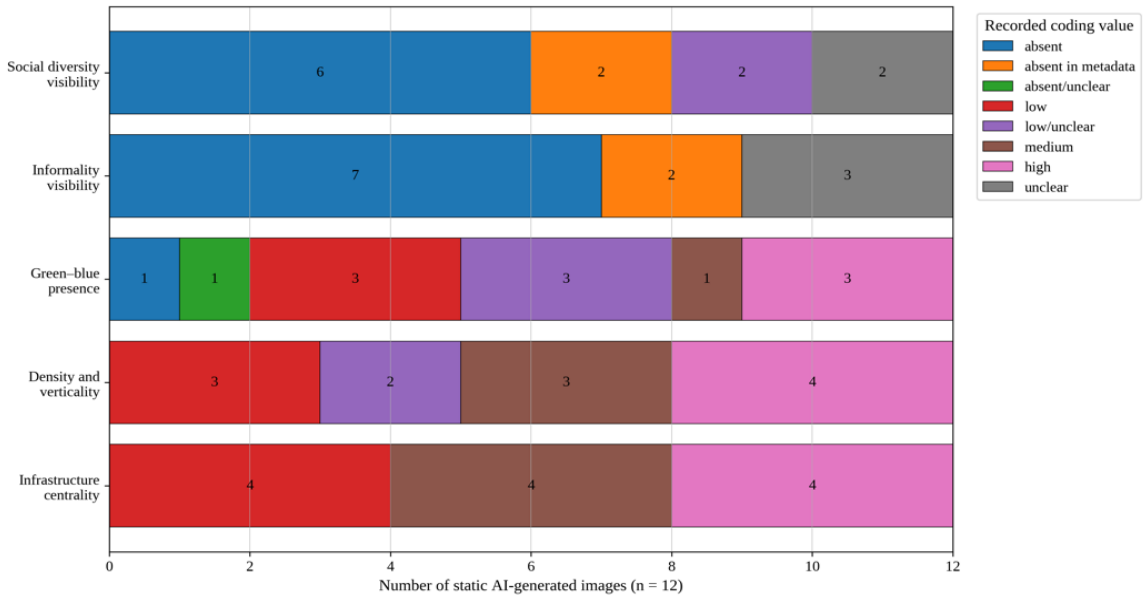

Figure 2. Distribution of spatial representation indicators

Infrastructure and verticality provide the most stable organizing features, although their prominence differs across locations. Jakarta is repeatedly condensed into skylines, toll roads, monuments, and iconic silhouettes, whereas Surabaya–Madura is structured through the Suramadu Bridge as a symbol of regional connectivity. Bandung introduces greater variation through commemorative architecture, religious monumentality, and peri-urban agricultural space, while Yogyakarta appears through commercial signage and nocturnal streetscape. Green and blue elements are distributed unevenly: three images give them high prominence, but other items position nature as peripheral, uncertain, or absent. Most strikingly, nine images contain no identifiable informal space, and eight provide no differentiated social diversity. These frequencies show that representational selectivity does not necessarily produce identical cities; instead, it repeatedly privileges infrastructure, architecture, and scenic order over ordinary social relations, neighbourhood complexity, and informal urban economies.

This distribution supports an understanding of algorithmic bias as patterned visibility rather than solely as erroneous classification. Urban-image systems organize knowledge through coverage, framing, and perceptual hierarchy, making some spatial features readily legible while rendering others peripheral or absent [5], [4], [7]. The prominence of bridges, skylines, monuments, and aerial landscapes corresponds with forms that are visually bounded, easily named, and compatible with established urban iconographies. Informality and social diversity, by contrast, require relational and contextual representation that cannot be captured through isolated landmarks alone. This does not demonstrate a particular training-data cause, nor does it establish intentional exclusion. It indicates that the corpus distributes representational attention asymmetrically. Indonesian cities consequently emerge as recognizable arrangements of infrastructure and symbolic architecture, while their social density, contested spatial practices, and everyday heterogeneity remain comparatively difficult to see.

Table 2. Distribution of spatial forms and visibility indicators in static AI-generated images

Analytical dimension	Indicator	Dominant recorded pattern	Frequency	Percentage	Distribution across corpus	Illustrative material	Data codes	Analytical reading
Spatial configuration	Dominant spatial typology	Regional infrastructure corridor	2	16.7%	Eleven typologies occurred across 12 images; ten appeared once each	Suramadu Bridge as metropolitan-regional connection	PRI-SBY-001; PRI-SBY-002	Urban identity is fragmented across iconic spatial forms rather than organized through one uniform city model
Infrastructure prominence	Centrality of engineered infrastructure	No single dominant level	4 per level	33.3% each	High = 4; medium = 4; low = 4	Toll road, bridge, monument district, and commercial street	PRI-JKT-002; PRI-SBY-001; PRI-BDG-001; PRI-YGY-001	Infrastructure is recurrent but unevenly positioned as either background, organizing axis, or primary urban identity
Built-form intensity	Density and verticality	High	4	33.3%	High = 4; medium = 3; low = 3; low/unclear = 2	Jakarta skyline and landmark-centred metropolitan imagery	PRI-JKT-001; PRI-JKT-003; PRI-JKT-004; PRI-JKT-005	Verticality is concentrated in Jakarta-related images rather than distributed evenly across represented cities
Environmental visibility	Green–blue presence	High, low, and low/unclear	3 each	25.0% each	High = 3; low = 3; low/unclear = 3; medium = 1; absent = 1; absent/unclear = 1	Suramadu waterscape and Bandung peri-urban rice fields	PRI-SBY-001; PRI-SBY-002; PRI-BDG-003	Environmental elements are visible but range from structural landscapes to scenic background
Marginalized spatial forms	Informality visibility	Absent	9	75.0%	Absent = 7; absent in metadata = 2; unclear = 3	No explicit kampung, informal settlement, or street-vending environment identified	PRI-JKT-001–005; PRI-SBY-001; PRI-BDG-001–002	Urban informality is largely outside the representational field despite its importance to Indonesian metropolitan life
Human presence	Social-diversity visibility	Absent	8	66.7%	Absent = 6; absent in metadata = 2; low/unclear = 2; unclear = 2	Monumental, infrastructural, and aerial scenes without differentiated social actors	PRI-JKT-001–003; PRI-JKT-005; PRI-SBY-001; PRI-BDG-001–003	Cities are more often represented as physical arrangements than as socially differentiated lived environments

4.2. Cultural recognition and semiotic depth in AI-generated Indonesian cities

Cultural recognizability is present across much of the visual corpus, but it is produced more consistently through named landmarks than through socially embedded cultural environments. Five of twelve images display high landmark specificity, and four provide medium specificity, indicating that most representations retain some geographically identifiable element. This recognizability weakens when attention moves from iconic objects to material, linguistic, and social dimensions of place. Vernacular architecture is absent from nine images, readable language or signage is absent from ten, and everyday practices are absent from seven. Cultural hybridisation reaches a medium level in seven items, suggesting that local symbols are commonly translated through globally familiar skyline, tourism, infrastructure, or architectural conventions. The central pattern is therefore not cultural erasure, but an uneven form of recognition in which place names and monuments remain visible while contextual cultural density becomes substantially thinner.

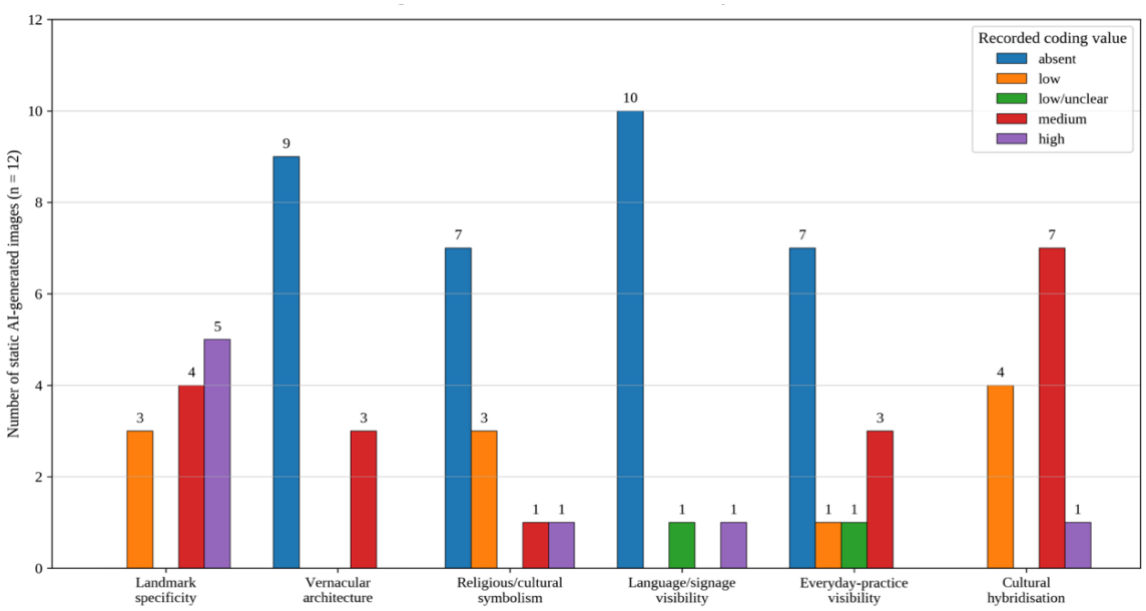

Figure 3. Distribution of cultural authenticity indicators

Landmark-centred representations provide the strongest place-specific signals. Jakarta is identified through the Selamat Datang Monument and selected skyline silhouettes, Surabaya–Madura through the Suramadu Bridge, and Bandung through Monumen Perjuangan and Al Jabbar Mosque. Yet these symbols are generally isolated from vernacular streets, routine interactions, and linguistic diversity. Only the Yogyakarta commercial scene gives language and signage high compositional visibility, although this visibility is organized primarily through transnational retail branding. Religious or cultural symbols are absent from seven images, while everyday practices appear at medium intensity in only three. Bandung-related materials display greater variation because monumental architecture is accompanied by a peri-urban agricultural landscape. Even here, however, the corpus provides limited evidence of inhabitants, labour relations, historical narratives, or culturally differentiated practices. Visual specificity therefore varies more strongly at the level of objects than at the level of lived urban culture.

These patterns complicate any equation between landmark recognizability and cultural authenticity. Generative imagery can identify a city correctly while still reducing its culture to a compact set of visually searchable signs. Campo-Ruiz (2025) [12] associates generative systems with diminished architectural diversity, while Foka and Griffin (2024) [10] and Karpouzis (2024) [11] emphasize that synthetic cultural representations are shaped by selection, mediation, and inherited hierarchies rather than transparent cultural knowledge. Indonesian visual-space studies similarly demonstrate that identity emerges through relations among architecture, signage, neighbourhood practices, street art, and political or commercial discourse [13], [15], [14]. From this perspective, the images produce authenticity through selective semiotic anchoring: local monuments establish recognition, but generic composition and limited social visibility restrict cultural depth. Authenticity consequently appears as a graded relational quality rather than a binary distinction between accurate and inaccurate representation.

Table 3. Distribution of cultural authenticity and semiotic-specificity indicators

Analytical dimension	Coding category	Frequency	Percentage	Distribution within indicator	Illustrative feature	Representative codes	Interpretation
Local landmark specificity	High	5	41.7%	High = 5; medium = 4; low = 3	Selamat Datang Monument, Suramadu Bridge, Monumen Perjuangan, and Al Jabbar Mosque	PRI-JKT-004; PRI-SBY-001–002; PRI-BDG-001–002	Place recognition frequently depends on monumental or iconic structures
Local landmark specificity	Medium	4	33.3%		Jakarta skyline icons and Bandung agricultural landscape	PRI-JKT-001; PRI-JKT-003; PRI-JKT-005; PRI-BDG-003	Locality remains recognizable but is mediated through generalized spatial motifs
Local landmark specificity	Low	3	25.0%		Toll-road view, carnival scene, and branded commercial streetscape	PRI-JKT-002; PRI-SBY-003; PRI-YGY-001	City names provide more specificity than represented cultural environments
Vernacular architecture	Absent	9	75.0%	Absent = 9; medium = 3	Modern skylines, infrastructure, commercial space, and abstract monuments	PRI-JKT-001–005; PRI-SBY-001–003; PRI-YGY-001	Regional architectural traditions rarely organize urban identity
Vernacular architecture	Medium	3	25.0%		Contextually grounded religious, commemorative, or peri-urban form	PRI-BDG-001–003	Bandung-related images provide comparatively stronger material specificity
Religious or cultural symbolism	Absent	7	58.3%	Absent = 7; low = 3; medium = 1; high = 1	Skyline, transport, leisure, and agricultural scenes without prominent cultural symbols	PRI-JKT-001–003; PRI-JKT-005; PRI-SBY-001–003	More than half of the corpus represents cities without explicit cultural-symbolic anchoring
Religious or cultural symbolism	Low to high	5	41.7%	Low = 3; medium = 1; high = 1	Urban monumentality and mosque architecture	PRI-JKT-004; PRI-BDG-001–002; PRI-BDG-003; PRI-YGY-001	Cultural visibility is concentrated in a limited group of landmark-centred images
Language and signage visibility	Absent	10	83.3%	Absent = 10; low/unclear = 1; high = 1	Images without readable Indonesian or regional-language signs	Most primary static codes	Linguistic identity is the least visible dimension of cultural specificity
Language and signage visibility	High	1	8.3%		Minimarket billboard and neon-box streetscape	PRI-YGY-001	Visible text appears mainly through commercial branding rather than civic or vernacular language

Everyday-practice visibility	Absent	7	58.3%	Absent = 7; medium = 3; low = 1; low/unclear = 1	Empty skylines, monuments, architectural details, and aerial landscapes	PRI-JKT-001; PRI-JKT-003–005; PRI-SBY-001; PRI-BDG-001–002	Urban culture is frequently detached from routine social action
Everyday-practice visibility	Medium	3	25.0%		Transport, leisure, and peri-urban productive space	PRI-JKT-002; PRI-SBY-003; PRI-BDG-003	Everyday life becomes visible mainly through broad functional settings
Cultural hybridisation	Medium	7	58.3%	Medium = 7; low = 4; high = 1	Local landmarks combined with global skyline, tourism, or design conventions	PRI-JKT-001; PRI-JKT-004; PRI-SBY-001–002; PRI-BDG-001–003	Local identity is commonly expressed through globally legible visual formats
Cultural hybridisation	Low	4	33.3%		Minimal line art, transport infrastructure, and generic leisure imagery	PRI-JKT-002–003; PRI-JKT-005; PRI-SBY-003	Limited cultural layering makes several scenes potentially interchangeable
Cultural hybridisation	High	1	8.3%		Local commercial space combining place, signage, branding, and nocturnal urbanity	PRI-YGY-001	Hybrid cultural visibility is strongest where multiple semiotic resources coexist
Authenticity risk	Dispersed across twelve categories	12	100%	Each category occurred once	Iconic compression, landmark essentialism, corporate standardisation, rural idyll, formal abstraction, and beautified connectivity	PRI-JKT-001–005; PRI-SBY-001–003; PRI-BDG-001–003; PRI-YGY-001	Cultural reduction is heterogeneous rather than produced through one recurring distortion

4.3. Spatial futures and the normalisation of urban modernity

Urban futurity emerges less through explicit temporal projection than through visual cues associated with modernization, technological order, and aesthetic refinement. Nine of twelve images combine present-day urban settings with future-coded elements, while only three remain clearly near-present, atemporal, or environmentally oriented. Medium technological solutionism appears in seven images, indicating that roads, bridges, towers, and geometrically designed architecture frequently signify progress without wholly replacing recognizable urban forms. A medium global-city aesthetic is present in eight items and reaches a high level in three, particularly in Jakarta skyline representations. By contrast, social inclusion is absent from seven images, and ecological futurity remains low in seven. The dominant pattern therefore constructs the future as an intensified version of existing metropolitan modernity rather than as a comprehensive transformation of social, environmental, and spatial relations.

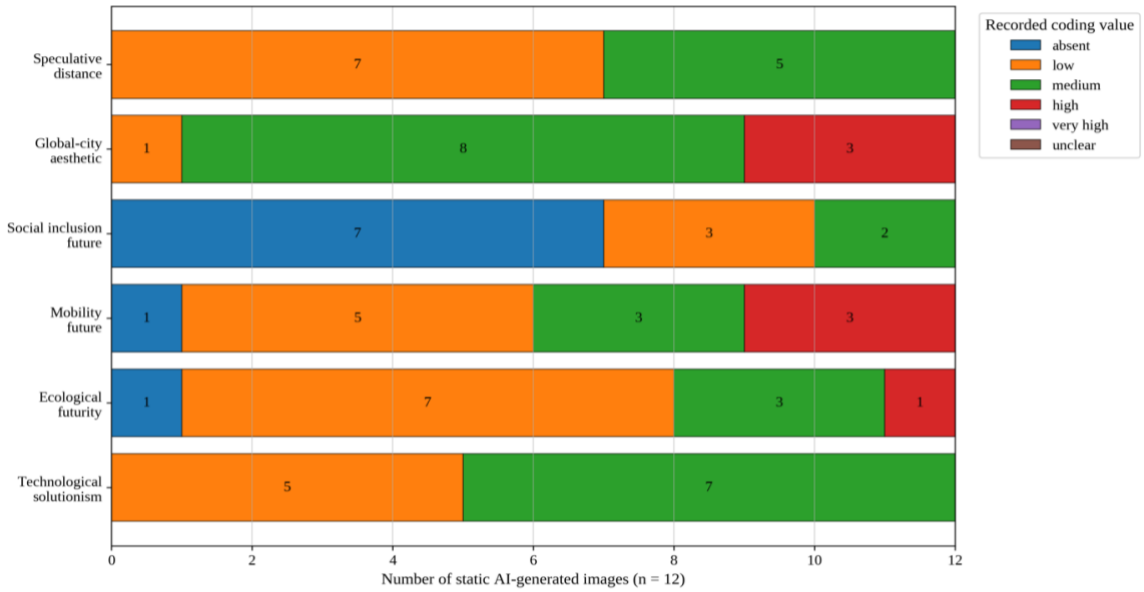

Figure 4. Distribution of spatial-futures indicators

Mobility and ecology enter the corpus unevenly. Transport futures are highly visible in three images centred on toll roads and the Suramadu Bridge, but remain low in five and absent in one, suggesting that connectivity becomes significant only when infrastructure dominates the composition. Ecological futurity reaches a high level solely in the Bandung peri-urban agricultural image, while water, greenery, and atmospheric landscapes generally function as scenic accompaniments. Most representations also retain low speculative distance: seven images reorganize recognizable urban landmarks or environments without radically departing from current spatial forms. Five images reach medium distance through stylised skylines, abstract commemorative architecture, or futuristic mosque design. Consequently, these urban futures are not primarily utopian transformations; they are visual upgrades that combine familiar places with cleaner, more ordered, technologically coded, and globally recognizable forms.

This pattern aligns with critical accounts of AI urbanism that distinguish technical imagination from socially grounded urban transformation. Palmini and Cugurullo (2023) [17] argue that artificial intelligence reshapes urbanism through spatial and conceptual priorities, while Bibri and Allam (2022) [18] associate data-driven futures with algorithmisation, platformisation, and hyper-connectivity. Batty (2024) [20] and Xu et al. (2024) [21] show how digital twins and generative systems can expand scenario production, yet such capacity does not guarantee cultural or distributive depth. The prominence of global-city aesthetics alongside weak social inclusion indicates that futurity is visualized chiefly through ordered form rather than through accessible institutions, plural publics, or contested urban needs. This study therefore positions algorithmic urban futures as selective propositions: they make technological modernization readily imaginable while rendering social redistribution, everyday participation, and ecological complexity comparatively less visible.

Table 4. Distribution of spatial-futures indicators in static AI-generated images

Analytical dimension	Dominant coding category	Freq.	Percent	Full distribution	Configuration	Representative codes	Initial interpretation
Technological solutionism	Medium	7	58.3%	Medium = 7; low = 5	Skyscrapers, toll roads, monumental bridges, geometric architecture, and engineered connectivity	PRI-JKT-001–002; PRI-SBY-001–002; PRI-BDG-001–002	Technology functions as a recurring sign of urban progress without fully dominating every image
Ecological futurity	Low	7	58.3%	Low = 7; medium = 3; high = 1; absent = 1	Water, greenery, sunset atmospheres, and agricultural landscapes	PRI-JKT-001; PRI-SBY-001–002; PRI-BDG-003	Environmental elements are usually scenic rather than structurally integrated into urban futures
Mobility future	Low	5	41.7%	Low = 5; medium = 3; high = 3; absent = 1	Toll roads, bridges, traffic corridors, and spatial connectivity	PRI-JKT-002; PRI-SBY-001–002	Mobility becomes prominent only when transport infrastructure forms the principal visual subject
Social inclusion future	Absent	7	58.3%	Absent = 7; low = 3; medium = 2	Empty skylines, landmark views, architectural details, and aerial scenes	PRI-JKT-001; PRI-JKT-003–005; PRI-SBY-001; PRI-BDG-001–002	Urban futures are frequently imagined without socially differentiated users
Homogenised global-city aesthetic	Medium	8	66.7%	Medium = 8; high = 3; low = 1	Glass towers, monumental infrastructure, clean compositions, neon spectacle, and stylised skylines	PRI-JKT-001–005; PRI-SBY-001–003; PRI-BDG-001–002	Place-specific symbols are commonly incorporated into globally legible visual conventions
Homogenised global-city aesthetic	High	3	25.0%	Included in distribution above	Skyline iconography and interchangeable metropolitan modernity	PRI-JKT-001; PRI-JKT-003; PRI-JKT-005	Jakarta-related representations most strongly approach generic global-metropolis imagery
Speculative distance	Low	7	58.3%	Low = 7; medium = 5	Existing landmarks and environments aesthetically intensified rather than radically transformed	PRI-JKT-002; PRI-JKT-004; PRI-SBY-001–003; PRI-BDG-003; PRI-YGY-001	Most images repackage current urban forms instead of constructing wholly unfamiliar futures
Speculative distance	Medium	5	41.7%	Included in distribution above	Stylised skylines, abstract monuments, and futuristic religious architecture	PRI-JKT-001; PRI-JKT-003; PRI-JKT-005; PRI-BDG-001–002	Moderate speculation emerges primarily through abstraction and visual stylisation
Overall future orientation	Modernisation without strong social redistribution	12	100%	Evident across combined indicators	Technological form and aesthetic order coexist with limited inclusion and weak ecological transformation	All static primary codes	Spatial futures are more consistently architectural and infrastructural than socially or institutionally transformative

5. DISCUSSION

The first implication concerns what becomes governable when Indonesian cities are rendered through infrastructure, skylines, monuments, and scenic order. Such imagery functions as a device of rapid urban recognition: viewers can identify Jakarta through verticality, Surabaya–Madura through Suramadu, and Bandung through monumental architecture. Yet this recognitional efficiency becomes dysfunctional when it narrows urban knowledge to bounded objects while marginalising informality, neighbourhood life, and differentiated social actors. The imbalance matters because algorithmic representation does not merely mirror cities; it contributes to the repertoire through which cities are imagined, compared, marketed, and planned. This interpretation supports Cinnamon's (2024) [5] argument that visual technologies unevenly render informal environments legible, and aligns with Fan et al. (2025) [4] and Zhang et al. (2024) [7], who show that coverage and framing structure urban visibility. Unlike studies centred on data completeness, however, this study indicates that representational selectivity can persist even when images remain geographically recognisable and aesthetically coherent.

Why does this pattern emerge? A plausible explanation lies in the structural compatibility between generative imagery and urban forms that are visually salient, semantically stable, and easily promptable. Bridges, towers, monuments, and skylines possess boundaries and circulated labels, whereas informal economies, mixed neighbourhoods, and social heterogeneity depend on relational context that is harder to compress into a single synthetic frame. Hou et al. (2024) [2] and Liu et al. (2023) [3] demonstrate that spatial models can transfer existing inequalities through proxies and explainability gaps, while Zhang et al. (2023) [6] distinguish objective mapping from subjective urban perception. This study does not identify a training mechanism, but its patterns are consistent with a structure in which indexed and symbolically dominant features gain representational stability. The issue is therefore not that AI fails to depict cities, but that it preferentially stabilises what is visually codified, producing cities legible as images yet incomplete as social spaces.

The second implication concerns cultural authenticity. The corpus demonstrates that local identity can be retained through landmarks, religious architecture, and named city symbols while cultural depth remains uneven. This distinction is significant because recognisability may function successfully for tourism, branding, and communication, yet become dysfunctional when a monument substitutes for the social relations, languages, memories, and practices that give it meaning. Campo-Ruiz (2025) [12] similarly finds that generative systems may reduce architectural diversity across cultural settings, while Foka and Griffin (2024) [10] and Karpouzis (2024) [11] caution that synthetic imagery mediates heritage through inherited representational hierarchies. The Indonesian material adds insight: authenticity is not simply lost, because place markers remain visible, but is redistributed toward objects that travel easily across platforms. This partially contrasts with accounts framing generative representation mainly as cultural erasure. Here, the stronger problem is selective preservation: culture survives as iconography, while linguistic, vernacular, and everyday dimensions remain more fragile.

This selective preservation can be explained by the unequal semiotic portability of cultural elements. Landmarks and monumental buildings are searchable, abundant, and visually distinctive; vernacular practices, multilingual signage, informal commerce, and neighbourhood interaction are dispersed, contextual, and often ambiguous. Aini (2026) [13], Sartono (2026) [14], and Daroji (2026) [15] show that Indonesian spatial identity emerges through layered relations among language, architecture, memory, and public practice, while Hidayat (2026) [16] demonstrates how tourism discourse can condense place into exoticised signs. The corpus reflects comparable compression, although not always through exoticism. Locality is frequently inserted into global compositional templates, producing cultural hybridisation but limited relational depth. This suggests that generative systems may privilege symbols with high recognitional value over practices with high contextual value. The underlying structure is therefore primarily semiotic rather than technical: cultural authenticity weakens when visual representation rewards portability, iconicity, and immediate recognition more strongly than historical embeddedness, social use, or linguistic plurality.

The third implication concerns the politics of urban futurity. The images make modernization imaginable through polished infrastructure, geometric architecture, skyline refinement, and controlled mobility, but they make inclusion, redistribution, and ecological complexity less visible. This functions productively by offering accessible scenarios of possible spatial transformation; it can support anticipation, design communication, and public engagement, as suggested by Batty (2024) [20] and Xu et al. (2024) [21]. Yet it becomes dysfunctional when future credibility is equated with visual cleanliness, frictionless movement, and global metropolitan form. Cao et al. (2025) [23] and Lazzeroni and Romano (2025) [22] show that AI-generated future cities rely on recurring narrative structures, while Beneduce et al. (2025) [24] identify geographic diversity deficits. This study extends those concerns by showing that future orientation

can remain partly implicit: contemporary landmarks become future-coded through aesthetic intensification. The future is therefore not always represented as temporal rupture, but as a polished amplification of existing urban hierarchies.

Why are these futures modernising rather than transformative? The underlying structure is a convergence between smart-city discourse, platform aesthetics, and the visual grammar of technological progress. Palmini and Cugurullo (2023) [17] argue that AI urbanism reorganises space through computational priorities, while Bibri and Allam (2022) [18] connect data-driven cities to platformisation and algorithmisation. Bibri et al. (2024) [25] and Allam et al. (2022) [19] emphasise sustainability and digital integration, but their possibilities coexist with the risk that technology becomes the principal language through which urban improvement is imagined. In this corpus, ecological futurity is scenic, social inclusion is weak, and speculative distance remains limited. These relationships do not prove that smart-city discourse causes representational homogenisation; they indicate that both share preferences for order, efficiency, connectivity, and visibility. This study therefore positions algorithmic urban futures as negotiated projections whose plausibility depends on technical sophistication and whether they preserve difference, social conflict, and situated ecological realities.

6. CONCLUSION

This study shows that AI-generated representations of Indonesian cities are culturally recognizable yet spatially selective. Urban identity is most consistently organized through skylines, infrastructure, monuments, and globally legible architectural forms, while informality, linguistic plurality, everyday practices, and socially differentiated users remain comparatively less visible. The principal lesson is that representational bias does not require complete cultural erasure; it can operate through selective preservation, where iconic elements survive but relational depth weakens. Methodologically, this study contributes an integrated framework combining spatial representation auditing, cultural-authenticity analysis, and spatial-futures interpretation, thereby extending AI urbanism research beyond technical performance toward questions of visibility, cultural specificity, and urban imagination.

This study is limited by its modest corpus, uneven city representation, dependence on publicly accessible platform materials, and exclusion of frame-level video analysis from cross-item frequency comparisons. It also cannot identify training-data mechanisms, platform effects, audience reception, or causal relationships between generated imagery and planning decisions. Future research should expand the corpus across additional Indonesian cities, languages, prompts, platforms, and generative models, while employing controlled prompt experiments and longitudinal comparison. Further work should incorporate expert assessment, community-based interpretation, and participatory evaluation with residents, planners, artists, and cultural practitioners to determine how synthetic urban imagery is recognized, contested, or rejected within situated Indonesian contexts.

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Fadilah Wasiqah: conceptualization, methodology, formal analysis, writing – original draft, writing – review and editing.

CONFLICT OF INTEREST STATEMENT

Author states no conflict of interest.

AI USE DECLARATION

The author used artificial intelligence tools to assist with the generation of illustrative figures and with the formatting and layout of this manuscript. AI was not used to generate the substantive content, conceptualization, data, analysis, or conclusions of the research, all of which remain the sole responsibility of the author.

INFORMED CONSENT

Not applicable – this study did not involve direct human participants. Data consisted solely of publicly accessible AI-generated images and contextual documents.

ETHICAL APPROVAL

This research did not involve human or animal subjects; it analyzed publicly accessible AI-generated images and contextual documents, and therefore no institutional review board approval was required. Where research does involve human subjects, the author affirms that such research would be conducted in full compliance with all relevant national regulations and institutional policies, in accordance with the tenets of the Declaration of Helsinki, and would be approved by the author's institutional review board or equivalent committee.

DATA AVAILABILITY

The corpus of documents analyzed in this study are publicly accessible and available from the corresponding author upon reasonable request.

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