Selected Papers of #AoIR2025:
The 26th Annual Conference of the
Association of Internet Researchers
Niterói, Brazil / 15 – 18 Oct 2025

WEB DETECTION METHODS FOR CONTEXTUAL INTERPRETATION OF IMAGE COLLECTIONS

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This paper repurposes AI web detection — an understudied method — to address a key methodological limitation in traditional visual media analysis within social media research and Internet studies. It integrates web semantic and contextual knowledge into image analysis, overcoming the reliance on manual coding, single-image studies (Vicari & Kirby, 2022; Bainotti, Caliandro, & Gandini, 2021; Rose, 2016), or Vision AI taxonomies (Colombo, Bounegru, & Gray, 2023; Pearce & Gaetano, 2021) that lack web knowledge. The web detection methods employed in this study leverage Google's Image Search ranking mechanisms and Knowledge Graph for data retrieval and contextualization (Google Cloud, 2017; Li et al. 2017; Sullivan, 2020), enabling the detection of web entities associated with images and webpages and image URLs that fully or partially match the original image collection.

The study finds that web entities, exact visual matching pages, and image URLs connect facts, topics, and concepts related to an image collection, positioning it within the freshest and most relevant web sources. Web detection methods offer a novel approach to studying issue mapping and cross-platform visual vernacular.

Suggested Citation (APA): Omena, J. J., Briones, A., Rodgers, S., Leite, E., & Ceh, S. (2025, October). *Web detection methods for contextual interpretation of image collections*. [Conference presentation]. AoIR 2025: The 26th Annual Conference of the Association of Internet Researchers, Niterói, Brazil. http://spir.aoir.org

Methodological findings are supported by a four-year digital methods study, using three unchanged image datasets to analyze AI web detection outputs over time. We employ quali-quanti methods (Venturini, 2024) to understand web detection technologies within their operational logic and socio-technical contexts, avoiding naive appropriation of AI outputs — namely, the tendency to rush into data analysis without critically assessing AI technicity (Omena, 2021). The paper contributes reproducible methods for contextual image interpretation.

The paper establishes a technical foundation for web detection methods, exploring their potential for contextual image interpretation. It then discusses conceptual interests in 'operational images' (Parikka, 2023) to conceptualize contextual image analysis proposed by the methods. The methodology section outlines the advanced employment of digital methods research, describing dataset building and adopting quali-quanti methods. Findings focus on four key themes: (1) contextual, (2) social perceptions, (3) ephemerality, and (4) technological grammar of web entities and exact visual matches. The ChatGPT case study provides proof of the methods, demonstrating how web entities and matching webpages support issue mapping and cross-platform visual vernacular analysis. We conclude by discussing the challenges of web detection methods.

Understanding Web Entities and Matching Webpages, Technically Speaking

A web entity is an identifiable concept or real-world object detected within unstructured web content, such as a person, thing, place, organization, event, or date. Web entities organize search results, helping the user find what she is interested in (Li et al. 2017). They are detected through Vision AI models and structured within knowledge graphs for contextual understanding and retrieval (Sullivan, 2020). Web entities "may include strongly related subjects not visually depicted in the image itself" (Leetaru, 2019) offering a web-based context that enriches image interpretation (Omena et al, 2021). Google Cloud Vision API detects web entities within batches of image collections and returns lists of webpages and URLs where full and partial matching images are found. These results are generated using Vision AI models, Google's ranking mechanisms via reverse image search, and the Knowledge Graph (Google Cloud, 2017a, b; Leetaru, 2019).

Conceptualizing Image Collection Analysis with Web Detection Methods

The web detection techniques outlined in this paper provide an applied set of methods that respond to growing conceptual interests in 'operational images' (Parikka, 2023). This refers to how digitalized images may possess representational qualities, but crucially, also datafied qualities necessary for operation in digital milieus such as social media platforms or image archives (Hui, 2016: 50). As MacKenzie and Munster (2019: 5) argue, the datafication of images entails the rise of new, large-scale ensembles of 'image matter' far less visible to researchers relying exclusively on traditional forms of image analysis, grounded in approaches such as semiotics, iconology, or iconography.

Methodology

This study builds on digital methods research's theoretical and practical foundations and follows the network vision methodology (Omena, 2024). In particular, it accounts for media technicity (Omena, 2022) and adopts quali-quanti visual methods, treating data and network visualization as a means of inquiry rather than a final product (Jacomy, 2021; Venturini, 2024). Figure 1 describes the image collections and datasets using AI web detection methods over different points—four years at the

maximum. 3D, bump charts and network visualizations address the following research questions:

1. How consistent are web entities, matching webpages, and image URL results over time? What do changes in these results reveal about the reliability of web-based knowledge in supporting the contextual interpretation of images?

Goal: Evaluate outputs insertions, deletions, and disappearance over time.

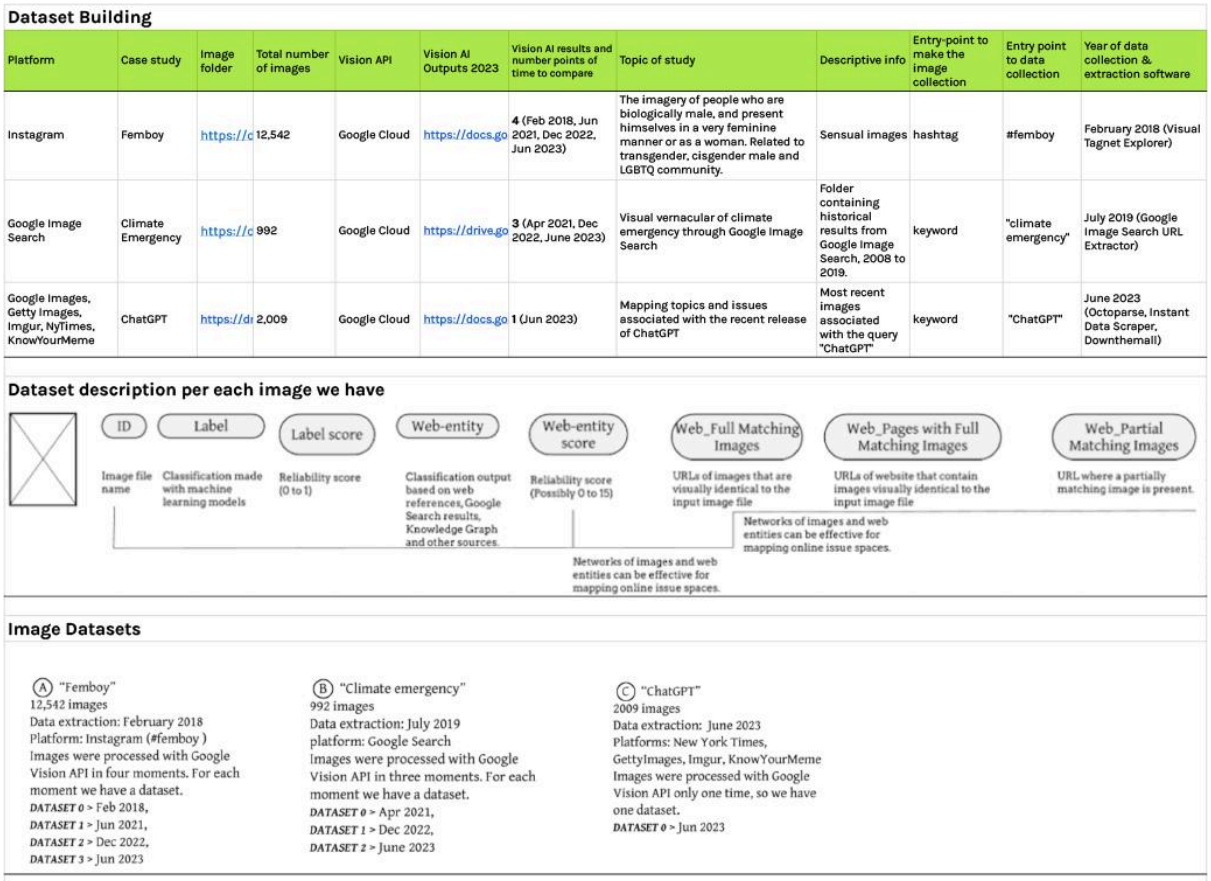
2. How do Google's image search ranking mechanisms and Knowledge Graph shape the contextual relevance of web detection results?

Goal: Interpret data and network visualization considering technical affordances and limitations of AI web detection.

3. What categories of top-level domains commonly appear in web detection outputs over time? How do authoritative sources influence the visibility and interpretation of image collections?

Goal: Detect the presence, absence, and distribution of authoritative sources and dominant top-level domains over the years.

Figure 1. Dataset building



Findings

(1) Contextual relevance of Web Entities

Through network vision methods and 3D data visualization applied to Climate Emergency image datasets (Figures 2,3), this study finds that **web entities are only contextually relevant if used in a timely manner**, underscoring their ephemeral nature.

Figure 2. Web detection methods prioritize fresh web references, as shown by cluster descriptive analysis: detailed web entity references diminish over time. Seeking fresh references for older datasets leads to a loss of contextual information.

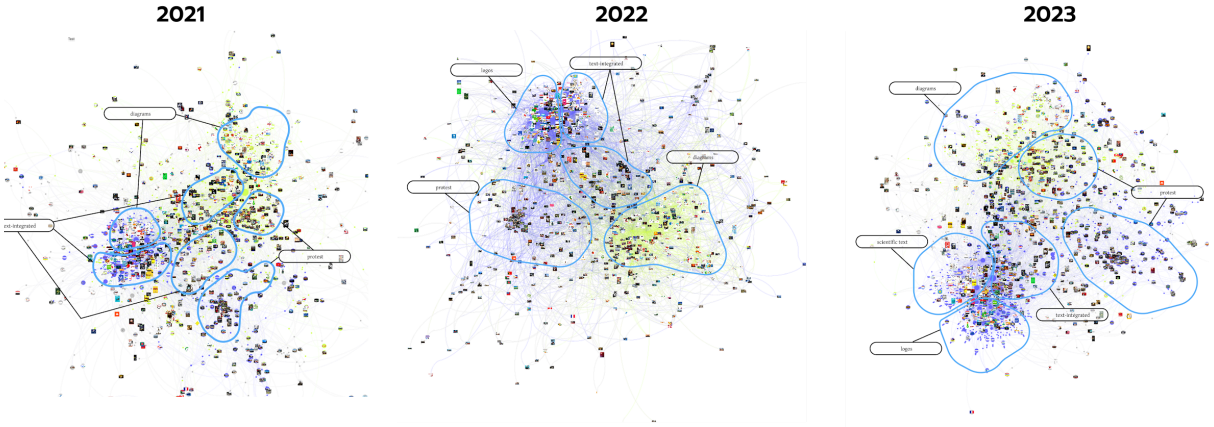
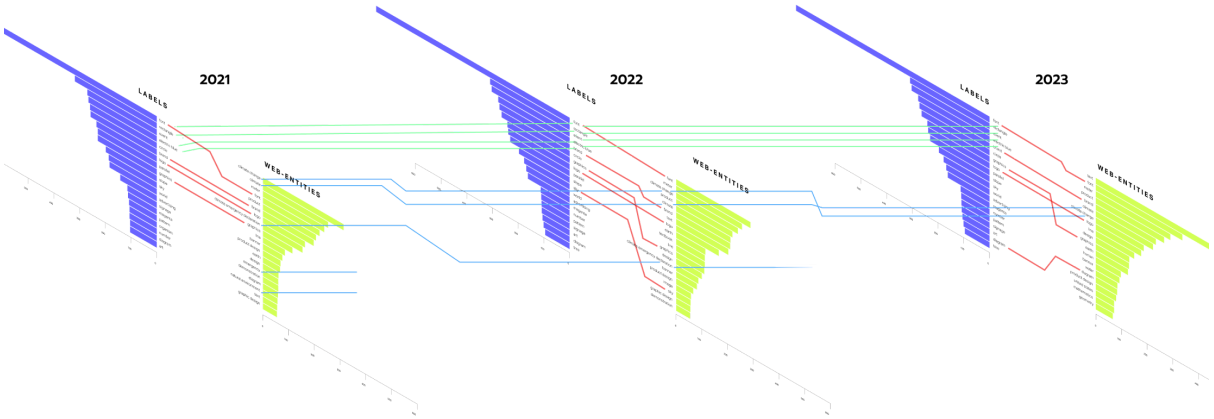


Figure 3. Web entities lose contextual relevance over time, as the same dataset demonstrates.



(2) Social perceptions reflected in web entities

Critical quantitative descriptive methods applied to Femboy datasets across four points in time, combined with network vision methods tracking web entity insertions and deletions (Figures 4, 5), reveal that **web entities mirror contemporary social perceptions.**

Figure 4. Unique count of web entities insertions and deletions over time.

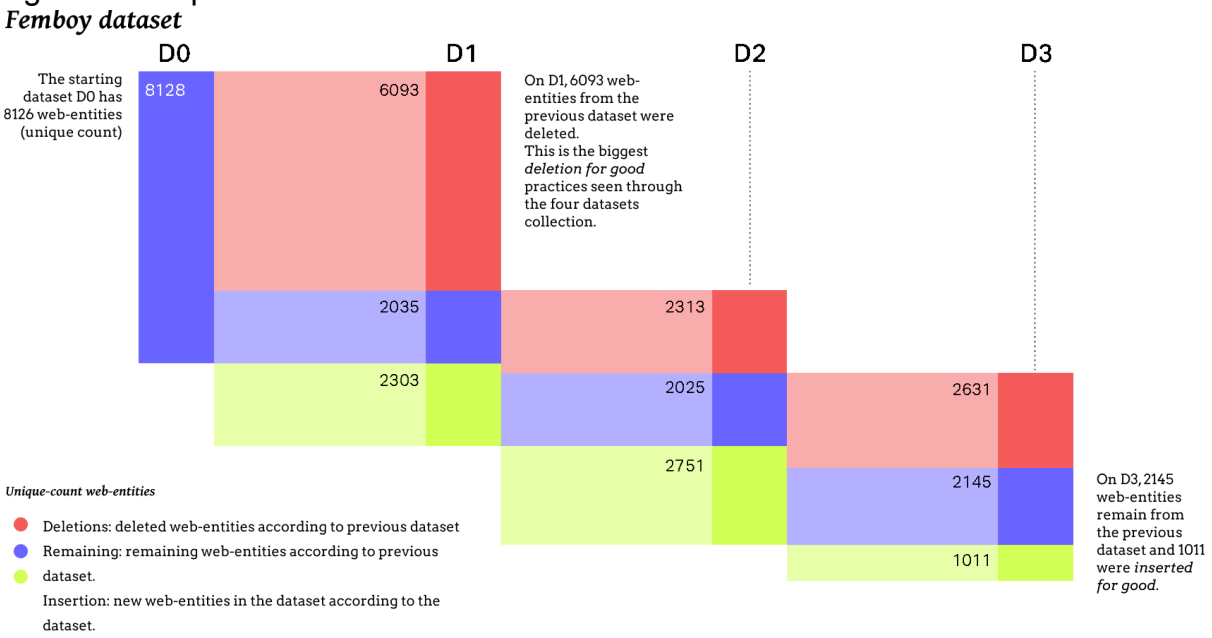
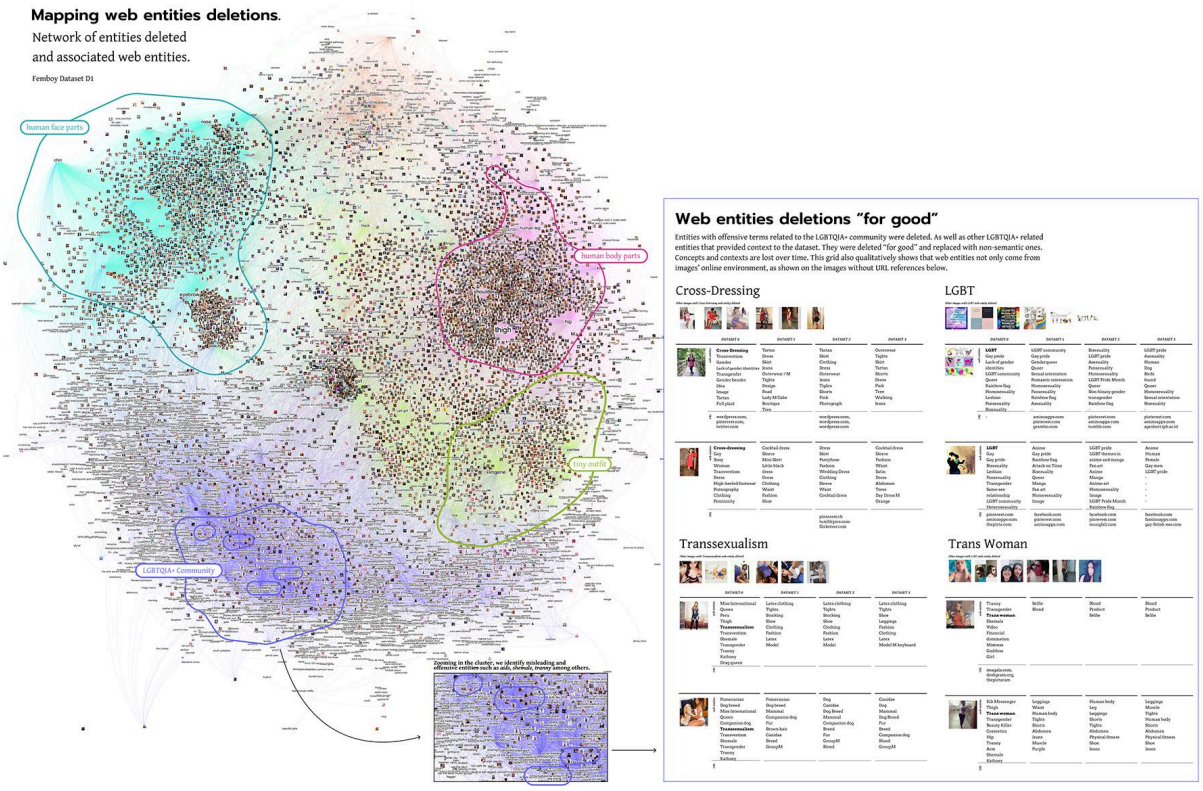


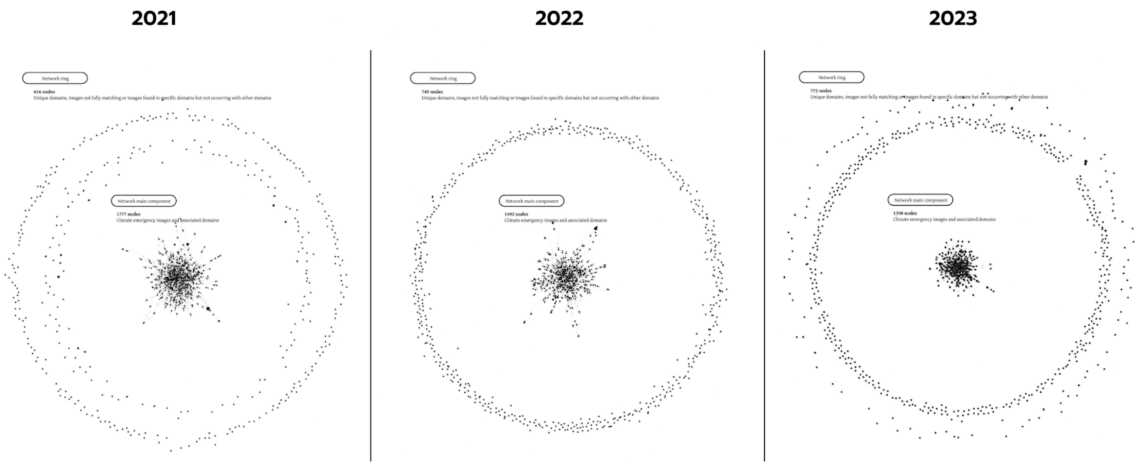
Figure 5. Derogatory terms like "shemale" and "tranny" in Femboy datasets illustrate how entities act as historical markers, reflecting societal categorization and perceptions of LGBTQIA+-related images.



(3) Ephemerality of exact visual matching

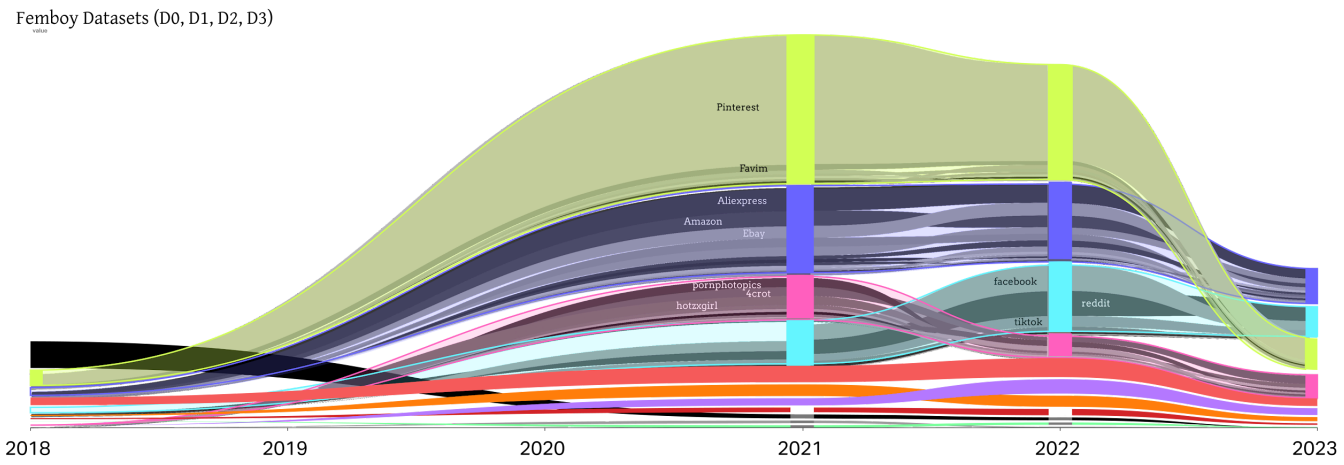
Temporal network vision methods tracking webpage and URL disappearance over three years (Figure 6) show that detecting fully matching images — crucial for studying image circulation and cross-platform visual vernaculars — is most effective when applied early in dataset building.

Figure 6. The giant component of image circulation networks shrinks over time, while the peripheral ring increases, indicating the disappearance or lack of associated webpages and URLs.



(4) Technological grammar of AI web detection
Since web detection methods predominantly return authoritative sources and dominant top-level domains, researchers must critically assess their influence on analytical focus and avoid disproportionately emphasizing their prominence. Bump chart visualizations of the Femboy and Climate Emergency datasets support these findings (Figure 7).

Figure 7. Web detection methods return outputs of the visible web.



(5) Proof of method: The ChatGPT case study
Network vision methods demonstrate how web entities cluster similar images into distinct network zones (Figure 8), highlighting their potential for mapping issue spaces aligned with web knowledge and context.

Figure 8. ChatGPT issue spaces and platform visual vernaculars.

The challenges of web detection methods

The paper addresses three main challenges:

1. Medium ephemerality – Social media image URLs are unstable, and platform restrictions on scraping or API calls limit data access.
2. Paid research practices – Web detection methods are not free. For instance, Google Vision AI charges $3.50 per 1,000 images beyond the initial 1,000 free units.
3. Digital Methods epistemology – AI system changes can unpredictably alter results, making it difficult to determine whether variations reflect cultural shifts or algorithmic adjustments.

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