RA 01 Annotated Bibliography- MATRIX 2022-23 **InterPARES Trust AI Project**

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Main focuses:

- archives using AI to curate images collections
- AI assisted software for image management
- existing practices by photography archives for providing access to images using software that has AI technology
- photographers using AI to manage their image archives

Source	Source Type	Summary	Key Points	Themes	Limitations
Angelova, L., Ogden, B., Craig, J., Chandrapal, H., & Manandhar, D. (2021). *Deep Discoveries: A Towards a National Collection Foundation Project Final Report*. Zenodo. https://doi.org/10.5281/zenodo.5710412	Project Report	Project exploring Computer Vision (CV) and Explainable Artificial Intelligence (XAI) for discovering/searching visual collections in novel and easier ways	- Developed user-tested CV-based search platform - Visually articulate search task and carry out a 'visual dialogue' with the AI to refine searches - CV search should provide both discovery-driven and research-specific capabilities - Allowed users to visualize how AI determined similarity between between user query image and returned image result - Several models: 3 network architectures trained for semantic classification on ImageNet dataset; 3 style-based models trained to discriminate fine-grained style collected from behance.net	Computer vision*; explainable artificial intelligence*; deep discoveries*; discovery;	No limitations found
Arnold, T., & Tilton, L. (2020). Enriching Historic Photography with Structured Data using Image Region Segmentation.	Conference Paper	Potential to increase discovery access through structured data and semantic web by using CV algorithms that automatically detect "stuff" - sky, water, etc.	- Applying method to documentary photographs from the US government in the 30s and 40s - Object annotations are useful, but have an error rate of 30% so manual validation is often necessary	Computer vision*; image segmentation*; cultural heritage*; photography*; Linked Data; ontology*; digital humanities*;	No foreseeable limitations

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Proceedings of the 1st International Workshop on Artificial Intelligence for Historical Image Enrichment and Access, 1–10. https://aclanthology.org/2020.ai4hi-1.1			- However, the "stuff" regions have an accuracy of 97.5% - Possibility for creating structured language for captions		
Aske, K., & Giardinetti, M. (2023). (Mis)matching Metadata: Improving Accessibility in Digital Visual Archives through the EyCon Project. *Journal on Computing and Cultural Heritage*. https://doi.org/10.1145/3594726	Journal article	Explores how metadata creation and enrichment can be improved using AI, specifically in relation to improving/correcting incomplete or inaccurate metadata	- Different institutions approach metadata creation in different ways creating a disparity in what kind of metadata exists, which is a drawback when researchers want to cross-examine photographs in potentially related collections at different institutions - EyCon has created their own training database extracted from different mediums as well as testing object detection algorithms to categorise images and enrich descriptive content metadata - Methodology for using pre-trained object detection steps: 1) choice of specific classes for that correspond to objects being detected 2) annotate part of corpus with all elements needed as well as location to automate recognition. Training is then semi-supervised to allow for AI to learn from algorithms - AI layout analysis that can detect and extract text blocks in publications	metadata*; accessibility*; visual archives*	No foreseeable limitations

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			- Also using CV to do similarity searches that are not reliant on existing metadata. They work solely by digital visual matching and extracting features of each image as vectors		
Bakker, R., Rowan, K., Hu, L., Guan, B., Liu, P., Li, Z., He, R., & Monge, C. (2020). AI for Archives: Using Facial Recognition to Enhance Metadata. *Works of the FIU Libraries*. https://digitalcommons.fiu.edu/glworks/93	Report	Determining most effective facial recognition applications to improve metadata for digital image archives	- Analyzed OpenCV, Face++, and Amazon AWS - In-house trained models need larger datasets for same quality of results compared to cloud-based platforms - But in-house models were faster - Cloud-based platforms are useful for easy-to-start environments	Facial recognition; digital archive; software	No foreseeable limitations
Eiler, F., Graf, S., & Dorner, W. (2018). Artificial intelligence and the automatic classification of historical photographs. *Proceedings of the Sixth International Conference on Technological Ecosystems for Enhancing Multiculturality*,	Conference Paper	Testing an artificial neural network (ANN) and convolutional neural network (CNN) to pre-classify and organise historic photographs. Dataset from Atelier Seidel, an archive & museum for photographs in South Bohemia.	- ANN had high accuracy of classification, which means they would be able to reduce classification uncertainty through a stable and standardized classification scheme - ANN-based classification is accurately replicable given there is already a training dataset available - CNNs can provide stable classification based on calculable accuracy	Machine learning*; computing methodologies*; software;	No foreseeable limitations

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852–856. https://doi.org/10.1145/3284179.3284324					
EyCon: Early Conflict Photography and Visual AI Project https://eycon.hypotheses.org/le-projet-en-quelques-mots/english	Project	Aims to connect and analyse siloed digitization efforts across institutions to increase discoverability and usability of overlooked and scattered material on colonial, imperial, and international armed conflict up to 1918	- 2 specific objectives: aggregate data into a thematic collection on early conflict photography; development of AI techniques for historical enquiry and data enrichment - Using AI tools to: compare and search images for similarities; isolate photographic tropes and subgenres, as well as anomalies in the database; retrain existing datasets	Access; discovery; archives; photography; digitization; classification	
https://link.springer.com/article/10.1007/s00146-021-01367-x					
https://link.springer.com/article/10.1007/s10502-022-09390-7					
Hagon, P. (2010). *Everything I learned about cataloging I learned from James Bond*. VALA2010 Connections Content	Conference Paper	Testing existing facial recognition software on historical photographs	- iPhoto 8.1 vs. Open CV - Resolution of images did not seem to affect accuracy - Open CV yielded more accurate results	Software; metadata; facial recognition;	Over a decade old research, technology has probably advanced

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Conversations, Melbourne. https://www.vala.org.au/vala2010/papers2010/VALA2010_65_Hagon_Final.pdf					
Han, X. Y., Papyan, V., Prokop, E., Donoho, D. L., & Johnson, Jr., C. R. (2022). Artificial intelligence and discovering the digitized Photoarchive. In L. Jaillant (Ed.), *Archives, Access and Artificial Intelligence: Working with Born-Digital and Digitized Archival Collections* (1st ed., Vol. 2, pp. 29–60). Bielefeld University Press / transcript Verlag. https://doi.org/10.14361/9783839455845	Book Chapter	Case study on Frick Art Reference Library's (FARL) Photoarchive using AI to annotate images using existing headings within Photoarchive's classification system	- Benefits of collaborating between cultural heritage preservationists and AI experts - Possibility for deep neural networks to be adapted to classify images via "specialized hierarchical, multilabel classification systems" - Proposed HCE loss and syntax-aware classifier - Accuracy of label depends on how many training images are tagged with that label	Neural networks; classification; digitization; machine learning*; image retrieval*; discoverability*; metadata creation*; digitized photoarchive*; FRICK	No limitations found; recent research

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Mensink, T., & van Gemert, J. (2014). The Rijksmuseum Challenge: Museum-Centered Visual Recognition. *Proceedings of International Conference on Multimedia Retrieval*, 451–454. https://doi.org/10.1145/2578726.2578791	Conference paper	Introducing Rijksmuseum dataset and 4 open challenges: predict artist, art-type, material, creation year	- Recognising need for automatic organising of visual art data - Brief overview of the 4 open challenges	Cultural heritage*; art dataset*; image classification*;	This is offering an challenge via open dataset but therefore no conclusions; not sure if that's useful
Niwata, and H. Watanave. "'Rebooting Memories': Creating 'Flow' and Inheriting Memories from Colorized Photographs." In SIGGRAPH ASIA Art Gallery/Art Papers, 1–12. SA '19. New York, NY, USA: Association for Computing Machinery, 2019. https://doi.org/10.1145/3354918.3361904.	Conference paper	Colorizing black and white photos using AI in order to create less distance from history	- Generating new interest in historic photographs - Colorization facilitates generation of a "flow" that in turn allows for lively communication about the photos - AI colorization not always accurate, sometimes required to hand-retouch	Cultural heritage; photography; discovery	Leans more toward using AI in ways to capture user attention

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Proctor, J., & Marciano, R. (2021). An AI-assisted framework for rapid conversion of descriptive photo metadata into linked data. *2021 IEEE International Conference on Big Data (Big Data)*, 2255–2261. https://doi.org/10.1109/BigData52589.2021.9671715	Conference Paper	Testing a computational processing workflow that integrates textual and photographic resources to create better contextual metadata in Spelman College photo archives.	- First step: statistical analysis of whole photo collection using OpenRefine - Creating Linked Data has significant value, but is very time consuming - This framework designed to work with existing item level metadata standards - Framework stages: input existing metadata; Text Analysis; Semantic Processing; Image Analysis; Linking - Strong results in Text Analysis, Image Analysis & Linking; promising results in Semantic Processing - Helps build a more streamlined approach for archivists to integrate deeper text-based contextual information into photos	Image analysis*; digital curation*; metadata*; photograph archives*; access; computer vision*; workflow	No limitations found; recent research
Sherratt, T., & Bagnall, K. (2019). The people inside. In K. Kee & T. Compeau (Eds.), *Seeing the Past with Computers* (pp. 11–31). University of Michigan Press. https://www.jstor.org/stable/j.ctvnjbdr0.4	Book Chapter	Using pre-trained Open CV Python script to identify portraits/photographs of faces among other archival documents at the National Archives of Australia	- Used screen-scrapers and Open CV to cull images into a collection showing history of White Australia policies - Difficulties working with limitations of RecordSearch, made easier with using Open CV	Cultural heritage; computer vision; digital humanities;	Less technical of a resource, more of a project summary . The fact that is it a National Archives might be useful for our focus on public records. JB
Wang, X., Ye, L., Keogh, E., & Shelton, C. (2008). Annotating historical archives of images. *Proceedings of the 8th ACM/IEEE-CS Joint Conference on*	Conference Paper	Attempt to use automatic annotation for historical images by linking attendant meta tags from contemporary images	- Important to use appropriate mix of color/shape/textures with algorithm - More specifically about images within historical books where text is easily analysed but images are not	Historical digital libraries*; image annotation*; information extraction*; labels;	Perhaps more process, less analysis

Digital Libraries, 341–350. https://doi.org/10.1145/1378889.1378948					
Milleville, K., Broeck, A. V. D., Vanderperren, N., Vissers, R., Priem, M., Van De Weghe, N., & Verstockt, S. (2023). Enriching Image Archives via Facial Recognition. *Journal on Computing and Cultural Heritage*, 3606704. https://doi.org/10.1145/3606704	Journal Article	Discussion based on generic image enrichment pipeline based on facial recognition in the FAME (facial recognition as a tool for metadata creation) project	- collaborative project with Meemoo (the Flemish Institute for Archives) and four content partners: Kunstenpunt (the Flanders Arts Institute), KOERS (the Museum of Cycle Racing), ADVN (Archive for National Movements), and the Flemish Parliament Archive. - Each partner provided a sample dataset - Build a reference set of known persons to be used to compare – however this usually has to be compiled manually and will be the most time-consuming. Need about 3-5 images per person for it to work - Include images in the ref set from a similar time period as the collection - number of detected faces per image can be a useful metric for various purposes. Can provide insights into past events and improve the search capabilities and accessibility of the collection. - identified by matching face embeddings from the reference set with the archive collections using cosine similarity - Able to identify connections between people using predicted person co-currences - Compared InsightFace and FaceNet	Facial recognition*; metadata enrichment*; computer vision*; cultural heritage*	

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			- Even with no fine-tuning of the pretrained models, over 93% of the person predictions are correct.		
Fang, J., Fong, C., Yang, P., Hung, C., Lu, W., & Chang, C. (2020). AdaGrad gradient descent method for AI image management. Paper presented at the 1-2. https://doi.org/10.1109/ICCE-Taiwan49838.2020.9258085	Conference Paper	Review and comparison of the AdaGrand (Adaptive Gradient) and Adam gradient descent method for optomizing deep learning for image identification.	- AdaGrand adapts to real-time deep learning (DL) based on gradient descent. Increasingly important as AI, and the accompanying DL, are exponentially more complex. - Using 6445 Tab-Seperated Value (TAB) images, the authors found AdaGrand was 99.86% accurate for identifying the aforementioned images after 10,000 iterations (runs).	Software; management; workflow; deep learning	AdaGrand is a slow adaptive gradient descent method to reach a high percentage of accuracy. TOO TECHNICAL- OMIT. JB
Kim, H. J., & Lee, H. (2022). Emotions and colors in a design archiving system: Applying AI technology for museums. Applied Sciences, 12(5), 2467. https://doi.org/10.3390/app12052467	Journal Article	The authors are advocating for an emotion-based AI image retrieval system for museums based on image metadata, colour, and “intangeble emotions.”	- Focused on art museums and the digital images created by these museum to represent to physical artwork. - Using an algorithm of their creation, the authors take each pixel of an image and turn it into one associated colour. This colour is considered a type of metadata that is processed via AI to produce a curated image retrieval system based on emotion attributed with the colour(s). - This retrieval system can also be searched using this emotion/colour metadata and the traditional metadata fields used in archives.	Archives; software; museums	Focused on identifying and collating digital image collections of artwork based on art history terminology for colour and their related emotion. Could be applied more broadly though.

Fuica, B. T., Buisson, O., & Mussou, C. (2021). Watching historical films through AI: Reflections on image retrieval from heritage collections. Cinergie, (20), 97-112. https://doi.org/10.6092/issn.2280-9481/13082	Journal Article	The authors offer a case study by testing how effective the AI program, Snoop, is to find patterns in historic film material (1900-1950) collected, by the TRANSARCHIVES film heritage and archival practice project, to aid research queries.	- Uses Snoop (AI developed specifically for audiovisual archives). This analyzes still frames to identify objects and subjects. - AI is reliable IF the time and resources are used to teach the necessary pre-conditions.	Audiovisual archives; film history; AI; object retrieval; software	Snoop's effectiveness was limited because of the quality of historic (1900-1950) films.
Chumachenko, K., Mannisto, A., Iosifidis, A., & Raitoharju, J. (2020). Machine learning based analysis of Finnish world war II photographers. IEEE Access, 8, 144184-144196. https://doi.org/10.1109/ACCESS.2020.3014458	Journal Article	The authors are arguing that machine learning (ML) algorithms can help social and historical research using various object detection software on WWII digitized photos. Using object detection for classification not description.	- Object detection software used: YOLOv3, SSD (single-shot detector), RetinaNet, & MASK R-CNN. - Their trained AI tools were able to identity some photographs taken by the same photographer. - Object detection trained for recognition of season/time of year, location (inside/outside), subject(s), object(s), and photograph's focus/main subject. - AI based on ML median scores of loss and success (gradient dissent method).	Machine learning; archives; photography; software; historical photo analysis	
Redmon, J., Divvala, S., Girshick, R., & Farhadi, A. (2016). You only look once: Unified, real-time object detection. Paper presented at the , 2016-779-788. https://doi.org/10.1109/CVPR.2016.91	Conference Paper	The authors are presenting You Only Look Once (YOLO) object detection to detect subjects and objects in photographs. **Note:** This conference paper can also be found as a journal article.	- YOLO is unified AI model for real-time object detection in photographs. "A single convolutional network simultaneously predicts multiple bounding boxes and class probabilities for those boxes. YOLO trains on full images and directly optimizes detection performance." (p. 779)	Photography; object detection; software	YOLO struggles with detailed, small subject, and multiple subject photographs.

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Mohanty, V., Thames, D., Mehta, S., & Luther, K. (2019). Photo sleuth: Combining human expertise and face recognition to identify historical portraits. Paper presented at the 547-557. https://doi.org/10.1145/3301275.3302301 https://www.civilwarphotosleuth.com/	Conference Paper	The authors' use "Photo Sleuth, a webbased platform that combines crowdsourced human expertise and automated face recognition to support Civil War portrait identification" (p. 547). Photo Sleuth is their own creation. Case study for crowd-sourcing and AI. **Note:** This conference paper can also be found as a journal article.	- Application of automated facial recognition algorithms and crowdsourcing. - **Photo Sleuth:** "does not depend on a training set. Instead, it exploits the strengths of existing face recognition algorithms in a hybrid pipeline by integrating additional relevant information from visual clues in a photograph into the search process to enhance accuracy" (p. 548) - Ultimately the project was quite successful in identifying, tagging, and adding photos. Users were very reliable in their added metadata and identification.	Facial recognition; photographs; AI	The AI software responsible for facial recognition requires interaction by users to identify individuals. This than has to be double checked by a professional. Basically Photo Sleuth is a database that relies on facial recognition AI to sort and crowdsourcing to identify.
Jiao, L., Zhang, F., Liu, F., Yang, S., Li, L., Feng, Z., & Qu, R. (2019). A survey of deep learning-based object detection. IEEE Access, 7, 128837-128868. https://doi.org/10.1109/ACCESS.2019.2939201	Journal Article	An in depth survey about object detection (what it is, how it occurs, what it can do, and what softwares use it).	- Comprehensive list of types of one-stage and two-stage object detectors. Includes each detector's pros and cons. - Helpful diagrams to illustrate how object detection works in photography. - Comprehensive list of what object detection can actually do.	Object detection; AI; ML; software	Article is a great base for understanding what software and tools are currently used for photography identification but it is from 2019 and some of the software has changed. IT FOUNDATIONAL DOC. JB
Prokop, E., Han, X. Y., Papyan, V., Donoho, D. L., & Johnson, C. R. (2021). AI and the digitized photoarchive: Promoting access and	Journal Article	Case study of the Frick Art Reference Library (FARL) in New York and their use of an AI algorithm for photographic classification based on visual elements.	- Modeled off the Witts library's photoarchive. - The AI algorithm appears to read written metadata from photo mounts released quickly in an effort to decrease digitization backlog.	AI; software; photographs; archives; access; FRICK	

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discoverability. Art Documentation, 40(1), 1-20. https://doi.org/10.1086/714604			- Applies automatic image classifiers to photographs.		
Ma, J. W., Czerniawski, T., & Leite, F. (2021). An application of metadata-based image retrieval system for facility management. Advanced Engineering Informatics, 50, 101417. https://doi.org/10.1016/j.aei.2021.101417	Journal Article	The authors are presenting their metadata image retrieval software for facility management.	- Uses three types of metadata for retrieval: location, perspective, and semantic content. - Organizes photos based on what metadata category (from the above three) you are searching for.	AI; software; photographs; metadata retrieval; management	Although this article is proposing this metadata retrieval system for facility management, it could be applied to archival photographs.
Spyrou, E., & Mylonas, P. (2016). Analyzing flickr metadata to extract location-based information and semantically organize its photo content. Neurocomputing (Amsterdam), 172, 114-133. https://doi.org/10.1016/j.neucom.2014.12.104	Journal Article	The authors are using an AI algorithm to analyze and cluster the location metadata of photographs from the social media site Flickr.	- The goal of analyzing and clustering social media photos through their location metadata to identify content trends.	Metadata; social media; photographs; AI	Although we are not looking at social media, the applications of this AI algorithm to search and cluster location metadata could be transferable.
Giovanni Colavizza, Tobias Blanke, Charles Jeurgens, and Julia Noordegraaf. 2021.	Journal Article (open source)			AI; archives; photographs	This article is NOT solely focused on AI and its use for object detection/image management in archives, but rather how AI fits within

Archives and AI: An Overview of Current Debates and Future Perspectives. J. Comput. Cult. Herit. 15, 1, Article 4 (December 2021), 15 pages. https://doi.org/10.1145/3479010					archives. It does include some tools for archives though.
Bunn, J. (2020), "Working in contexts for which transparency is important: A recordkeeping view of explainable artificial intelligence (XAI)", Records Management Journal, Vol. 30 No. 2, pp. 143-153. https://doi.org/10.1108/RMJ-08-2019-0038	Journal Article	The author is discussing how XAI (explainable AI) and how it impacts record keeping activities. Notably, this article does touch on how XAI impacts trust within recordkeeping. **Note**: Specifically touches on LD's definitions. And IP2 work.		XAI; record keeping; archives; trust	
Rolan G., Humphries G., Jeffrey L., Samaras E., Antsoupova T. and Stuart K. (2018) "More human than human? Artificial intelligence in the archive", Archives & Manuscripts, 47(2), pp. 179–203. doi: 10.1080/01576895.2018.1502088.	Journal Article			AI; archives; Australia	

Melvin Wevers, Thomas Smits, The visual digital turn: Using neural networks to study historical images, Digital Scholarship in the Humanities, Volume 35, Issue 1, April 2020, Pages 194–207, https://doi.org/10.1093/llc/fqy085	Journal Article			Digital humanities; AI; photographs	
Cléri, I., Pierrot-Deseilligny, M., and Vallet, B.: Automatic Georeferencing of a Heritage of old analog aerial Photographs, ISPRS Ann. Photogramm. Remote Sens. Spatial Inf. Sci., II-3, 33–40, https://doi.org/10.5194/isprsannals-II-3-33-2014, 2014.	Journal Article		- Use of AI to identify locations in analog historical aerial photos.	AI; Analog; Photographs; Heritage	Outdated; from 2014.

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Thematic organization of sources in the above matrix:

(1) Solely about AI software/tools and image detection

- Jiao, L., Zhang, F., Liu, F., Yang, S., Li, L., Feng, Z., & Qu, R. (2019). A survey of deep learning-based object detection. IEEE Access, 7, 128837-128868. https://doi.org/10.1109/ACCESS.2019.2939201

- Chumachenko, K., Mannisto, A., Iosifidis, A., & Raitoharju, J. (2020). Machine learning based analysis of Finnish world war II photographers. IEEE Access, 8, 144184-144196. https://doi.org/10.1109/ACCESS.2020.3014458

- Fang, J., Fong, C., Yang, P., Hung, C., Lu, W., & Chang, C. (2020). AdaGrad gradient descent method for AI image management. Paper presented at the 1-2. https://doi.org/10.1109/ICCE-Taiwan49838.2020.9258085

- Redmon, J., Divvala, S., Girshick, R., & Farhadi, A. (2016). You only look once: Unified, real-time object detection. Paper presented at the , 2016- 779-788. https://doi.org/10.1109/CVPR.2016.91

(2) AI tools for GLAM photo management

- *Digitized Artwork*
  - Kim, H. J., & Lee, H. (2022). Emotions and colors in a design archiving system: Applying AI technology for museums. Applied Sciences, 12(5), 2467. https://doi.org/10.3390/app12052467

  - Prokop, E., Han, X. Y., Papyan, V., Donoho, D. L., & Johnson, C. R. (2021). AI and the digitized photo archive: Promoting access and discoverability. Art Documentation, 40(1), 1-20. https://doi.org/10.1086/714604
  -
- *Digitized historical photos*
  - Fuica, B. T., Buisson, O., & Mussou, C. (2021). Watching historical films through AI: Reflections on image retrieval from heritage collections. Cinergie, (20), 97-112. https://doi.org/10.6092/issn.2280-9481/13082

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- Mohanty, V., Thames, D., Mehta, S., & Luther, K. (2019). Photo sleuth: Combining human expertise and face recognition to identify historical portraits. Paper presented at the 547-557. https://doi.org/10.1145/3301275.3302301

(3) AI tools for born-digital photos

- Ma, J. W., Czerniawski, T., & Leite, F. (2021). An application of metadata-based image retrieval system for facility management. Advanced Engineering Informatics, 50, 101417. https://doi.org/10.1016/j.aei.2021.101417

- Spyrou, E., & Mylonas, P. (2016). Analyzing flickr metadata to extract location-based information and semantically organize its photo content. Neurocomputing (Amsterdam), 172, 114-133. https://doi.org/10.1016/j.neucom.2014.12.104

(4) AI in archives

- Giovanni Colavizza, Tobias Blanke, Charles Jeurgens, and Julia Noordegraaf. 2021. Archives and AI: An Overview of Current Debates and Future Perspectives. J. Comput. Cult. Herit. 15, 1, Article 4 (December 2021), 15 pages. https://doi.org/10.1145/3479010

User-Focused Searching/Discovery

- Angelova, L., Ogden, B., Craig, J., Chandrapal, H., & Manandhar, D. (2021). *Deep Discoveries: A Towards a National Collection Foundation Project Final Report*. Zenodo. https://doi.org/10.5281/zenodo.5710412

- Arnold, T., & Tilton, L. (2020). Enriching Historic Photography with Structured Data using Image Region Segmentation. *Proceedings of the 1st International Workshop on Artificial Intelligence for Historical Image Enrichment and Access*, 1–10. https://aclanthology.org/2020.ai4hi-1.1

- Niwata, and H. Watanave. "'Rebooting Memories': Creating 'Flow' and Inheriting Memories from Colorized Photographs." In SIGGRAPH ASIA Art Gallery/Art Papers, 1–12. SA '19. New York, NY, USA: Association for Computing Machinery, 2019. https://doi.org/10.1145/3354918.3361904.

Description/Metadata

- Bakker, R., Rowan, K., Hu, L., Guan, B., Liu, P., Li, Z., He, R., & Monge, C. (2020). AI for Archives: Using Facial Recognition to Enhance Metadata. *Works of the FIU Libraries*. https://digitalcommons.fiu.edu/glworks/93

- Hagon, P. (2010). *Everything I learned about cataloging I learned from James Bond*. VALA2010 Connections Content Conversations, Melbourne. https://www.vala.org.au/vala2010/papers2010/VALA2010_65_Hagon_Final.pdf

- EyCon: Early Conflict Photography and Visual AI Project. https://eycon.hypotheses.org/le-projet-en-quelques-mots/english

Classification/Digital Curation(?)

- Eiler, F., Graf, S., & Dorner, W. (2018). Artificial intelligence and the automatic classification of historical photographs. *Proceedings of the Sixth International Conference on Technological Ecosystems for Enhancing Multiculturality*, 852–856. https://doi.org/10.1145/3284179.3284324

- Han, X. Y., Papyan, V., Prokop, E., Donoho, D. L., & Johnson, Jr., C. R. (2022). Artificial intelligence and discovering the digitized Photoarchive. In L. Jaillant (Ed.), *Archives, Access and Artificial Intelligence: Working with Born-Digital and Digitized Archival Collections* (1st ed., Vol. 2, pp. 29–60). Bielefeld University Press / transcript Verlag. https://doi.org/10.14361/9783839455845

- Mensink, T., & van Gemert, J. (2014). The Rijksmuseum Challenge: Museum-Centered Visual Recognition. *Proceedings of International Conference on Multimedia Retrieval*, 451–454. https://doi.org/10.1145/2578726.2578791

- Proctor, J., & Marciano, R. (2021). An AI-assisted framework for rapid conversion of descriptive photo metadata into linked data. *2021 IEEE International Conference on Big Data (Big Data)*, 2255–2261. https://doi.org/10.1109/BigData52589.2021.9671715

- Sherratt, T., & Bagnall, K. (2019). The people inside. In K. Kee & T. Compeau (Eds.), *Seeing the Past with Computers* (pp. 11–31). University of Michigan Press. https://www.jstor.org/stable/j.ctvnjbdr0.4

- Wang, X., Ye, L., Keogh, E., & Shelton, C. (2008). Annotating historical archives of images. *Proceedings of the 8th ACM/IEEE-CS Joint Conference on Digital Libraries*, 341–350. https://doi.org/10.1145/1378889.1378948

Categorization of AI projects and Software:

Source	Project Aim	AI Technology Used	Type of Image Collection	Directly related to archives (Y/N)
Kim, H. J., & Lee, H. (2022). Emotions and colors in a design archiving system: Applying AI technology for museums. Applied Sciences, 12(5), 2467. https://doi.org/10.3390/app12052467	The authors are advocating for an emotion-based AI image retrieval system for museums based on image metadata, colour, and “intangeble emotions.”	Researcher-created AI algorithm that associated pixels of a digitized image to a pre-coded emotional colour.	Digitized (artwork)	No; museums

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Fuica, B. T., Buisson, O., & Mussou, C. (2021). Watching historical films through AI: Reflections on image retrieval from heritage collections. Cinergie, (20), 97-112. https://doi.org/10.6092/issn.2280-9481/13082	The authors offer a case study by testing how effective the AI program, Snoop, is to find patterns in historic film material (1900-1950) collected, by the TRANSARCHIVES film heritage and archival practice project, to aid research queries.	Snoop	Digitized (historical B&W images)	Yes; audiovisual archives.
Redmon, J., Divvala, S., Girshick, R., & Farhadi, A. (2016). You only look once: Unified, real-time object detection. Paper presented at the , 2016-779-788. https://doi.org/10.1109/CVPR.2016.91	The authors are presenting You Only Look Once (YOLO) object detection to detect subjects and objects in photographs.	YOLO (You Only Look Once) version 1.	Digitized	No.
Mohanty, V., Thames, D., Mehta, S., & Luther, K. (2019). Photo sleuth: Combining human expertise and face	The authors' use "Photo Sleuth, a web based platform that combines crowdsourced human expertise and	Photo Sleuth	Digitized (Civil-war portraits)	No; this is a research created database, but it could be applied to an archive.

recognition to identify historical portraits. Paper presented at the 547-557. https://doi.org/10.1145/3301275.3302301	automated face recognition to support Civil War portrait identification" (p. 547). Photo Sleuth is their own creation. Case study for crowd-sourcing and AI.			
Prokop, E., Han, X. Y., Papyan, V., Donoho, D. L., & Johnson, C. R. (2021). AI and the digitized photoarchive: Promoting access and discoverability. Art Documentation, 40(1), 1-20. https://doi.org/10.1086/714604	Case study of the Frick Art Reference Library (FARL) in New York and their use of an AI algorithm for photographic classification based on visual elements.	Researcher-created AI algorithm to read analouge metadata and automatically classify photographs	Digitized (artwork)	No; from a reference library (Frick Art Reference Library)
Ma, J. W., Czerniawski, T., & Leite, F. (2021). An application of metadata-based image retrieval system for facility management. Advanced Engineering Informatics, 50, 101417. https://doi.org/10.1016/j.aei.2021.101417	The authors are presenting their metadata image retrieval software for facility management.	Uses a metadata image retrieval software based on location, perspective, and semantic content of the image.	Born digital images	No; facility management

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Spyrou, E., & Mylonas, P. (2016). Analyzing flickr metadata to extract location-based information and semantically organize its photo content. Neurocomputing (Amsterdam), 172, 114-133. https://doi.org/10.1016/j.neucom.2014.12.104	The authors are using an AI algorithm to analyze and cluster the location metadata of photographs from the social media site Flickr to identify content trends.	Uses AI algorithms to analyze and cluster social media photos through location metadata.	Born digital images	No; social media

Emerging Gaps:

1. AI software is primarily used for *digitized* photographs in GLAM organizations (relating to backlog).
    a. **Note**: the archives examined do not fit the "public" definition of archives.
2. There are lots of AI software and tools but few are specifically geared towards archives. Majority appears to be customized (and presumably pricey) or out of the box that requires training.
3. From a contemporary diplomatic analysis point of view, there are no discussions of how AI technology/software/tools maintain the trust ontology.
4. We need definitions for "object detection" and "image management" and figure out which we are focused on.
    a. Does object detection fit within image management?

Emerging Gaps 2.0

1. Mainly research on digitised photos; no born-digital projects (although touched upon by Jaillant article https://link.springer.com/article/10.1007/s00146-021-01367-x)

2. Are there more examples of intra-institutional work like EyCon? So far the focus seems pretty siloed within individual institutions. Future uses are expected to be searches across institutional collections; however structured data and linked data are required to support that functionality. Additionally, to scale up will involve increased computing power.
3. Brief mentions of AI vs. human error/accuracy; would be interesting to find more detail on this.
4. User interaction studies?