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Looking for a Needle in a Haystack: How can Vision-Language Understanding Help to Identify Privacy-Threatening Images on the Web

Sergej Schultenkämper and Frederik Simon Bäumer
Hochschule Bielefeld – University of Applied Sciences and Arts

IARIA ADRIAN dtec.bw

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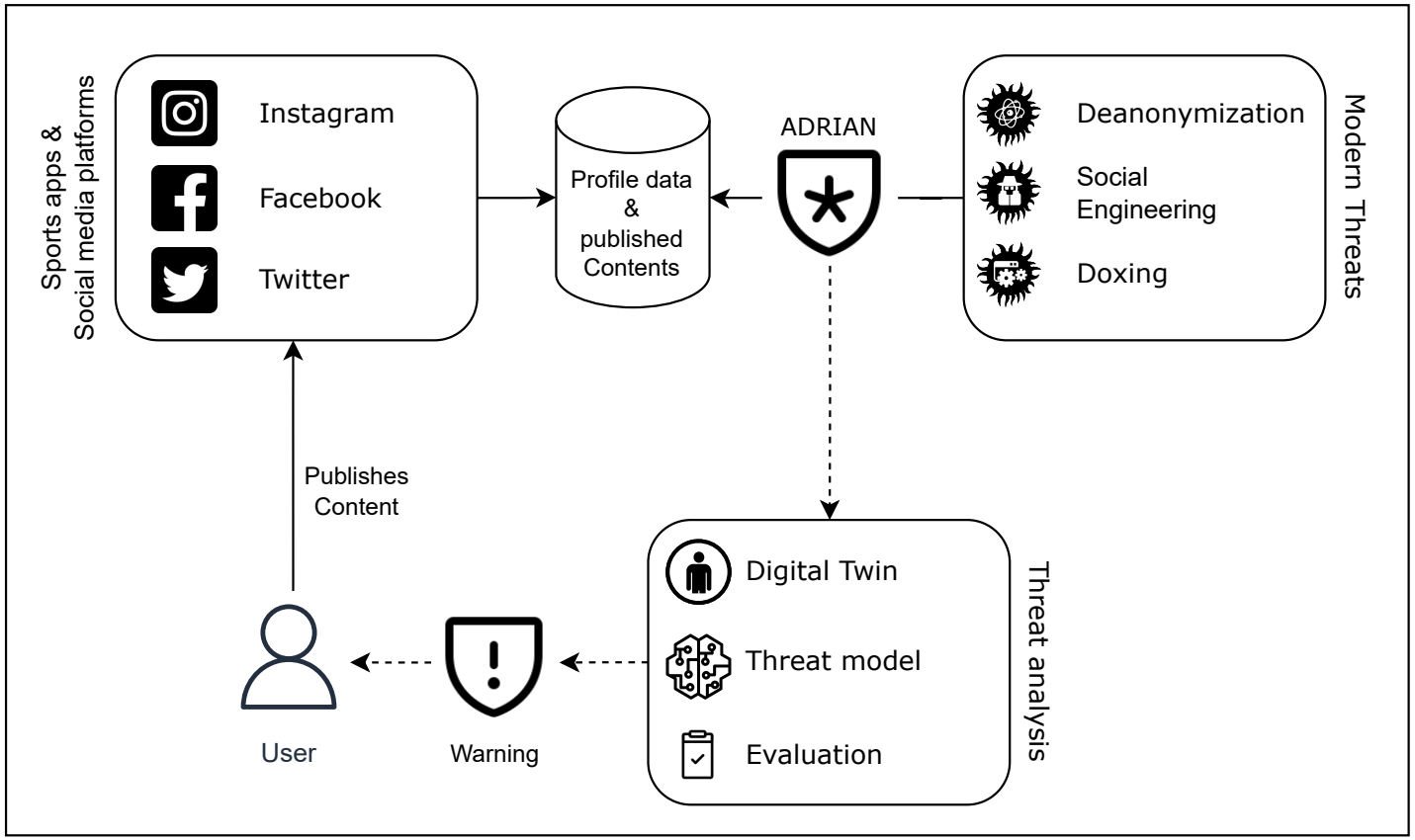
AGENDA

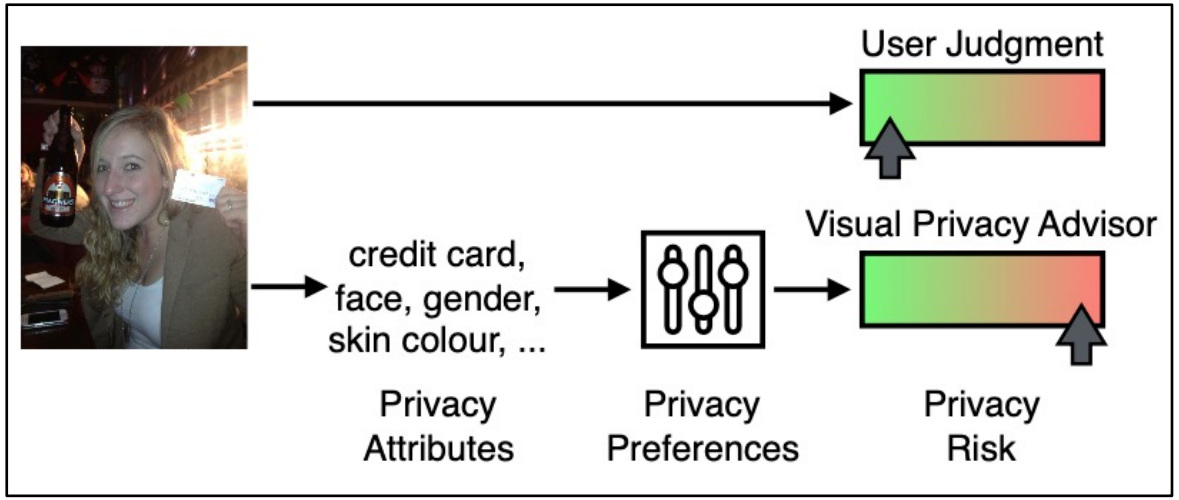
- Motivation
- Approach
- Visual Question Answering
- Dataset
- Results
- Discussion and Conclusion

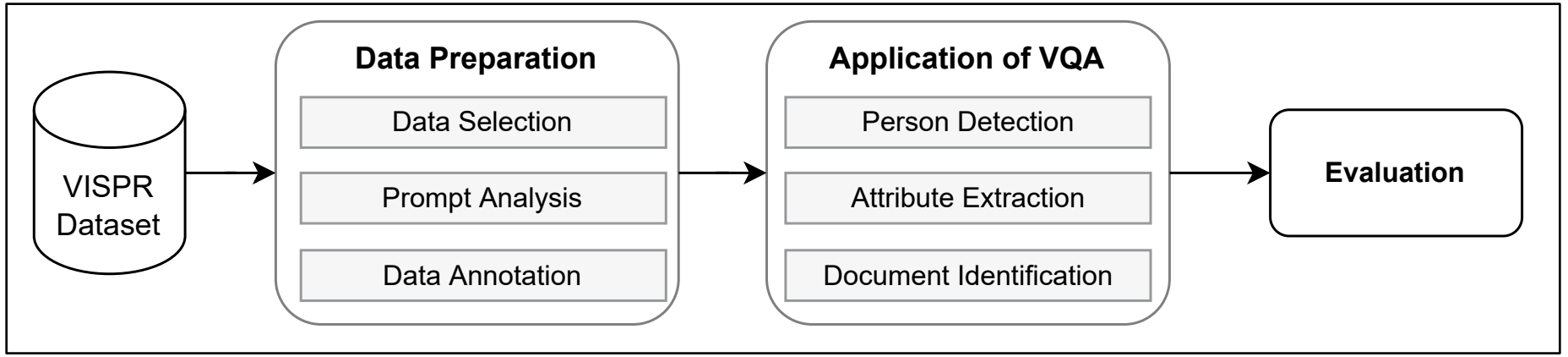
MOTIVATION (ADRIAN RESEARCH PROJECT)



APPROACH

- Visual Privacy (VISPR) Dataset
- Privacy Attribute Analysis (**persons** and **documents**)

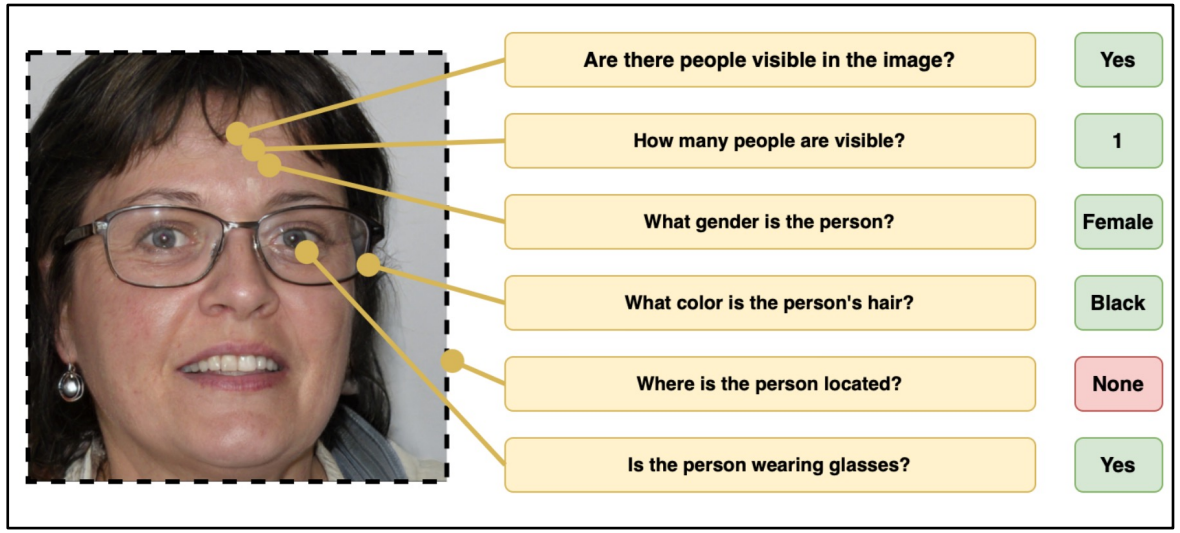




Source: T. Orekondy, B. Schiele, and M. Fritz, “Towards a Visual Privacy Advisor: Understanding and predicting privacy risks in images,” in Proceedings of the IEEE International Conference on Computer Vision, 2017, pp. 3686–3695.

VISUAL QUESTION ANSWERING

- **Goal**: Automatically extract sensitive information from images using VQA
- **Approach**: Analyzing the performance of Vision-Language Models, such as BLIP



DATASET

- Focus on:
  - **Person characteristics**
  - **Documents**
- Further annotated 5 existing classes, leading to the creation of a **new dataset** for person characteristics

Attribute Id	Description	# of Images
a1	Age Group	1711
a4	Gender	1863
a5	Eye Color	1348
a6	Hair Color	1759
a11	Tattoo	45
a12	Semi-nudity	247
a13	Full nudity	11
a17	Skin Color	1914
a29	National Identification	47
a30	Credit Card	97
a31	Passport	263
a32	Driver’s License	70
a33	Student ID	70
a39	Physical Disability	41

DATASET

- Person detection, 1000 Images annotated to identify whether there are **none**, **one**, or **multiple** persons in the image
- Extraction and further analysis of person characteristics from images featuring **one** person

Label	Prompt & Answer Candidates
a1_age_approx	How old is the person?
	[**child**, **adult**, **elderly**]
a4_gender	What is the gender of the person?
	[**male**, **female**]
a5_eye_color	Which color are the eyes of the person?
	[**blue**, **green**, **gray**, **brown**]
a6_hair_color	Which color is the hair of the person?
	[**black**, **blond**, **brown**, **gray**, **red**]
a11_tattoo	Does the person have a tattoo?
	[yes, no]
a12_semi_nudity	Is the person partially nude?
	[yes, no]
a13_full_nudity	Is the person fully nude?
	[yes, no]
a17_color	What is the skin color of the person?
	[**black**, **brown**, **white**]
a29_ausweis, a30_credit_card, a31_passport, a32_drivers_license, a33_student_id	Which document is in this picture?
	[national identification card, credit card, passport, driver's licence, student ID]
a39_disability_physical	Does the person have a disability?
	[yes, no]

RESULTS (EXAMPLES)

(a) Positive Example #1

(b) Positive Example #2

(c) Negative Example #1

(d) Negative Example #2

	Precision	Recall	F1-score	Support
Person Detection				
No person	0.9977	0.9363	0.9660	455
1 person	0.8269	0.9923	0.9021	130
>1 person	0.9730	0.9783	0.9757	369
Accuracy	--	--	**0.9602**	--
Age				
Adult	0.9853	0.9313	0.9575	1295
Child	0.9607	0.9293	0.9448	184
Elderly	0.6818	0.9626	0.7982	187
Accuracy	--	--	**0.9346**	--
Gender				
Female	0.9865	0.9787	0.9826	894
Male	0.9784	0.9862	0.9823	872
Accuracy	--	--	**0.9824**	--
Hair Color				
Black	0.9749	0.9637	0.9692	523
Blond	1.0000	0.3457	0.5138	188
Brown	0.8416	0.9825	0.9066	687
Gray	0.8870	0.8160	0.8500	125
Red	0.6667	0.9630	0.7879	54
Accuracy	--	--	**0.8865**	--

DISCUSSION AND CONCLUSION

- **Person characteristics**: BLIP effectively recognizes people, stands out in the age, gender and skin color recognition, and provides satisfactory results for eye and hair color
- **Challenges**: A current challenge involves differentiating real people from statues or emblems
- **Document Identification**: BLIP works well with passports and credit cards, but faces difficulties with driver's licenses and national identification cards
- **BLIP Model**: This model is well-suited for processing large amounts of data and extracting textual information
- **ADRIAN Research Project**: The textual information extracted can be leveraged to expand the Digital Twin within the project

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Thank you for your attention!