

Ilth IEEE International Conference on Automatic Face and Gesture Recognition



DE -ID

De-identification for privacy protection in multimedia content.

### Distinguishable De-identified Faces

Zongji Sun, Dr Lily Meng and Prof Aladdin Ariyaeeinia, School of Engineering and Technology, University of Hertfordshire, Hatfield, UK, AL10 9AB



#### Outline

- Previous work of face de-identification
- *k*-Same family of face de-identification methods
- Motivation of this work
- Overview of the proposed method
- Experimental results
- Conclusions





#### Previous (related) work

• Ad hoc methods: blurring, pixelation, censor bars



[1]

[2]

[3]

• These ad hoc methods cannot protect their deidentified faces from face recognition software.





Face features in a simplified 2D illustration



Face features in a simplified 2D illustration





De-identification for privacy protection in multimedia content. University*of* Hertfordshire



Face features in a simplified 2D illustration



4







• The first member: k-Same-Eigen, 2005 [4]

•	Limitations	Solutions
	Preservation of data utility	k-Same-Select, 2005 [5]
	Ghost artefacts	k-Same-M, 2006 [6]
	Limited privacy protection	k-Same-furthest, 2014 [7]



Original





De-identification for privacy protection in multimedia content.



 $k = 4 \qquad k = 8 \qquad k = 6$ 



#### Our previous work – k-Same-furthest





DE -ID



• People share the same de-identified face





• People share the same de-identified face







• People share the same de-identified face







• People share the same de-identified face







• People share the same de-identified face





• People share the same de-identified face





• People share the same de-identified face



• Impossible to track/distinguish individuals in a deidentified video.





Face features in a simplified 2D illustration





De-identification for privacy protection in multimedia content. University of Hertfordshire

#### Face features in a simplified 2D illustration





De-identification for privacy protection in multimedia content. University*of* Hertfordshire

Face features in a simplified 2D illustration







De-identification for privacy protection in multimedia content. University of Hertfordshire



for privacy protection in multimedia content. University*of* Hertfordshire





De-identification for privacy protection in multimedia content. University of Hertfordshire



for privacy protection in multimedia content. University*of* Hertfordshire

#### Face features in a simplified 2D illustration









De-identification for privacy protection in multimedia content. University of Hertfordshire

#### *k*-Diff-furthest de-identified faces

#### • Original faces



• De-identified faces







#### Protection of original identities

Processing of *k*-Diff-furthest illustrated with a simplified example in 2D space









## Recognition rates for de-identified faces against their original faces





#### Diversity of face datasets

- Histogram of feature distances of original faces and various sets of de-identified faces when k=5
- Distribution of k-Difffurthest de-identified face set have the similar outline with the original face data set





#### Experimental results by k-Difffurthest

#### Original faces



#### De-identified faces (k=5)





#### Experimental results by k-Difffurthest

#### **Original faces**



#### De-identified faces (k=5)



#### Conclusions

- Main contribution: distinguishable deidentified faces.
- Diversity of the original face set is maintained in the de-identified face set.
- Perfect privacy protection performance is achieved.



#### References

- Blurring example image [available on: http://cnet2.cbsistatic.com/hub/i/r/2008/05/13/e0ceb6e1-f8fb-11e2-8c7cd4ae52e62bcc/thumbnail/770x433/a4637468a88162ae78615867cbd89d48/ face\_blurring\_street\_view\_5.13.2008.png]
- [2] Pixelation example image [available on: http://ak3.picdn.net/shutterstock/videos/2826664/preview/stock-footagewaving-anonymously-pixelated.jpg]
- [3] Censor bar example image [available on: http://www.likecool.com/Style/Accessories/Censorship%20Sunglasses/Censo rship-Sunglasses.jpg]





#### References

- [4] E. M. Newton, L. Sweeney, and B. Malin, "Preserving privacy by de-identifying face images," IEEE Trans. Knowl. Data Eng., vol. 17, no. 2, pp. 232–243, Feb. 2005.
- [5] R. Gross, E. Airoldi, B. Malin, and L. Sweeney, "Integrating Utility into Face Deidentification," in Proceedings of the 5th International Conference on Privacy Enhancing Technologies, 2005, pp. 227–242.
- [6] R. Gross, L. Sweeney, F. de la Torre, and S. Baker, "Model-Based Face De-Identification," in 2006 Conference on Computer Vision and Pattern Recognition Workshop (CVPRW'06), 2006, pp. 161–161.
- [7] L. Meng and Z. Sun, "Face De-identification with perfect privacy protection," in 2014 37th International Convention on Information and Communication Technology, Electronics and Microelectronics (MIPRO), 2014, pp. 1234–1239.







# Thank you









## Questions?



