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Image Similarity Estimation Based on Ratio and Distance Calculation between Features

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Abstract

Some similarity functions for comparing the features of objects in the processing of static images and video sequences are proposed. These functions provide the possibility to find the normalized similarity value and are determined by calculating the ratios between the minimum and maximum values for all the pairs of analyzed features. To find the complex value characterizing the similarity of compared images as a whole, the summation or multiplication of calculated ratios is used. It is proposed to take into account the distances between features for such types of calculations. Some results of experimental studies on the comparison of the qualitative characteristics of similarity functions, their robustness against different types and levels of noises, and the possibility of the precise localization of objects on an image for the case when the brightness levels of pixels are used as features are presented.

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REFERENCES

1. 1

R. C. Gonzalez and R. E. Woods, *Digital Image Processing*, 3rd ed. (Prentice Hall, Upper Saddle River, NJ, 2008; Tekhnosfera, Moscow, 2012).

2. 2

R. Klette, *Concise Computer Vision. An Introduction into Theory and Algorithms* (Springer, London, 2014); *Computer Vision. Theory and Algorithms* (DMK Press, Moscow, 2019) [Russian translation].

3. 3

A. A. Goshtasby, "Similarity and dissimilarity measures," in *Image Registration. Principles, Tools and Methods*, Advances in Computer Vision and Pattern Recognition (Springer, London, 2012), Chapter 2, pp. 7–66.

4. 4

B. Zitová and J. Flusser, "Image registration methods: a survey," *Image Vision Comput.* **21** (11), 977–1000 (2003).

[Article Google Scholar](#)

5. 5

S.-H. Cha, "Comprehensive survey on distance/similarity measures between probability density functions," *Int. J. Math. Models Methods Appl. Sci.* **1** (4), 300–307 (2007).

Google Scholar

6. 6

M. Rezaei and P. Fränti, “Set matching measures for external cluster validity,” *IEEE Trans. Knowl. Data Eng.* **28** (8), 2173–2186 (2016).

Article Google Scholar

7. 7

V. Gesù and V. Starovoitov, “Distance-based functions for image comparison,” *Pattern Recogn. Lett.* **20** (2), 207–214 (1999).

Article Google Scholar

8. 8

L. Wang, Y. Zhang, and J. Feng, “On the Euclidean distance of images,” *IEEE Trans. Pattern Anal. Mach. Intell.* **27** (8), 1334–1339 (2005).

Article Google Scholar

9. 9

A. Nakhmani and A. Tannenbaum, “A new distance measure based on generalized Image Normalized Cross-Correlation for robust video tracking and image recognition,” *Pattern Recogn. Lett.* **34** (3), 315–321 (2013).

Article Google Scholar

10. 10

N. G. Zagoruiko, I. A. Borisova, V. V. Dyubanov, and O. A. Kutnenko, “A quantitative measure of compactness and similarity in a competitive space,” *J. Appl. Ind. Math.* **5** (1), 144–154 (2011).

[Article Google Scholar](#)

11. 11

G. Lv, “ l_m : A novel similarity measure for matching local image descriptors,” *IEEE Access* **6**, 55315–55325 (2018).

[Article Google Scholar](#)

12. 12

J.-I. Kim, Ch.-U. Hyun, H. Han, and H.-C. Kim, “Evaluation of matching costs for high-quality sea-ice surface reconstruction from aerial images,” *Remote Sens.* **11** (9), 1055–1072 (2019).

[Article Google Scholar](#)

13. 13

R. Bohush and I. Zakharava, “Robust person tracking algorithm based on Convolutional Neural Network for indoor video surveillance,” in *Pattern Recognition and Information Processing, PRIP 2019*, Ed. by S. V. Ablameyko, V. V. Krasnoproshin, and M. M. Lukashevich, Communications in Computer and Information Science (Springer, Cham, 2019), Vol. 1055, pp. 289–300.

Google Scholar

14. 14

S. V. Voronov and A. G. Tashlinskii, “Efficiency analysis of information theoretic measures in image registration,” *Pattern Recogn. Image Anal.* **26** (3), 502–505 (2016).

Article Google Scholar

15. 15

S. V. Voronov and A. G. Tashlinskii, “Analysis of objective functions in the problem of estimating mutual geometric deformations of images,” *Pattern Recogn. Image Anal.* **24** (4), 575–582 (2014).

Article Google Scholar

16. 16

M. M. Deza and E. Deza, *Encyclopedia of Distances* (Springer, Berlin, Heidelberg, 2009).

Book Google Scholar

17. 17

S. Chambon and A. Crouzil, “Dense matching using correlation: new measures that are robust near occlusions,” in *Proc. British Machine Vision Conference (BMVC 2003)* (East Anglia, Norwich, UK, 2003), Vol. 1, pp. 143–152.

18. 18

J. Nakamura (ed.), *Image Sensors and Signal Processing for Digital Still Cameras* (CRC Press, Boca Raton, 2005).

[Google Scholar](#)

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Ethics declarations

The authors declare that they have no conflicts of interests.

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