

Proximity Matrix and Its Applications

by

Li Jinbo



Master of Science in Software Engineering

2013



**Faculty of Science and Technology
University of Macau**

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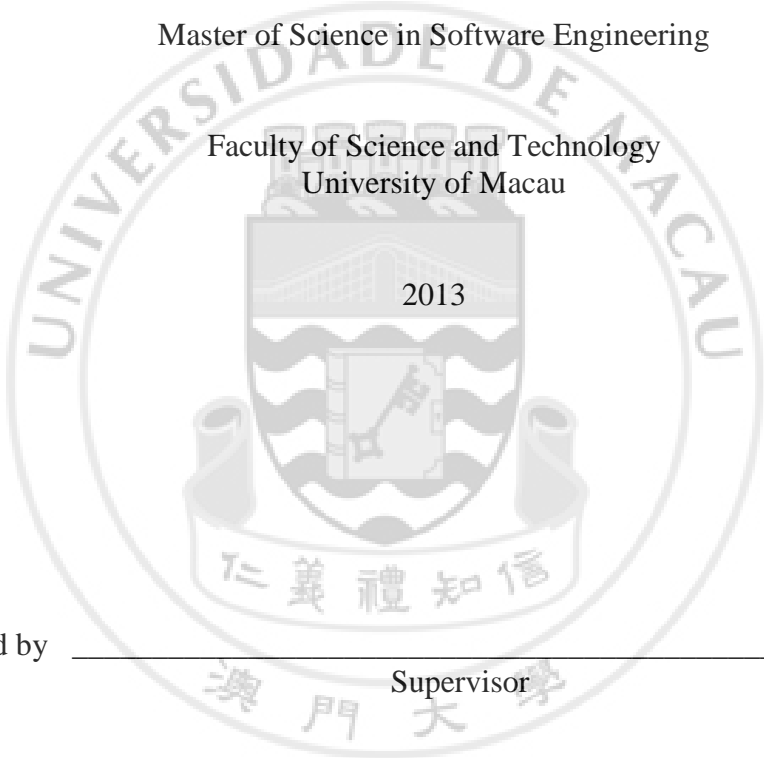
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A thesis submitted in partial fulfillment of the requirements for the degree of

Master of Science in Software Engineering

Faculty of Science and Technology
University of Macau



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Abstract

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Proximity matrix has made important contribution in diverse fields such as clustering analysis and pattern recognition. In this thesis, after revisiting the definition and generation of proximity matrix, we focus on its two applications, which are semi-supervised clustering and multifocus image fusion.

Proximity-based fuzzy c-means algorithm (PFCM), a classical semi-supervised clustering algorithm, concerns with the number of proximity “hints” or constraints that specify an extent to which some pairs of instances are considered similar or not. By replacing the fuzzy c-means in P-FCM with a kernel fuzzy c-means, we propose a new semi-supervised clustering algorithm named proximity-based kernel fuzzy c-means (PKFCM), which not only can cluster non-linearly separable data but also can utilize the user inputs about proximity among data to guide the clustering. In addition, PKFCM is able to apply the user inputs to select decent parameters for kernel functions. Simulations on some synthetic data demonstrate the feasibility and advantages of proposed

Multifocus image fusion is another work about the application of proximity matrix. Due to the nature of involved optics, the depth of field in imaging systems is usually constricted in the field of view. As a result, we get the image with only parts of the scene in focus. To extend the depth of field, fusing the images at different focus levels is a promising approach. We propose a novel multifocus image fusion approach in which proximity matrix-based normalized cut is used to partition the clarity enhanced image instead of source images. On the one hand, using clarity enhanced image that contains both intensity and clarity information, the proposed method decreases the risk of partitioning the in-focus and out-of-focus pixels in the same

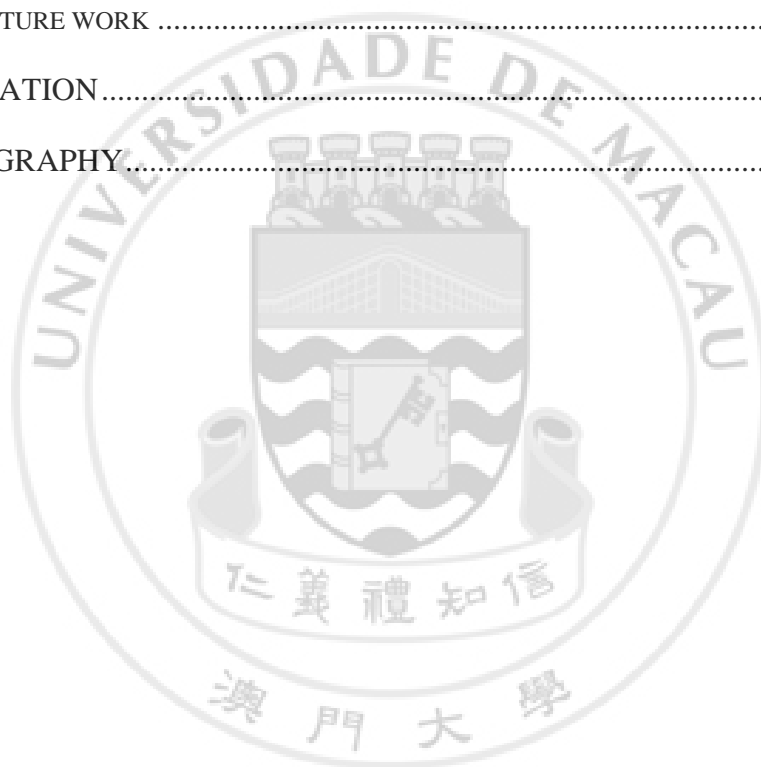
region. On the other hand, due to the regional selection of sparse coefficients, the proposed method strengthens its robustness to the distortions and misplacement usually resulting from pixel based coefficients selection. In short, the proposed method combines the merits of regional image fusion and sparse representation based image fusion. The experimental results demonstrate that the proposed method outperforms six recently proposed multifocus image fusion methods.



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LIST OF ABBREVIATIONS

P-FCM. Proximity-based fuzzy c-means clustering

KFCM. Kernel fuzzy c-means clustering

PKFCM. Proximity based Kernel Fuzzy C-Means clustering

Ncut. Normalized cuts

EMD. Earth mover's distance



ACKNOWLEDGEMENTS

Firstly, I want to express my deep appreciation to Dr. Chen Long for giving me this great chance to grow. He continued giving me suggestions even after leaving the lab. He has my highest regards. I am actually thankful for his confidence and thoroughness.

Then, I have had a great life here in University of Macau. I am thankful for this period. I will miss this all.

Finally, I also want to thanks to my family and friends who have given help to me through this whole process.

I thank everyone who has given me this great period of life.

This thesis was supported in part by the Research Committee at University of Macau under grant SRG004-FST12-CL.

