

# Review Paper Multilevel Thresholding Selection Based on the Artificial Bee Colony Algorithm for Image Segmentation

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## Abstract

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## 1. INTRODUCTION

*Thresholding* adalah teknik yang paling penting dalam proses *image segmentation*. Tujuannya adalah menentukan ambang batas untuk bi-level atau beberapa ambang multi level untuk proses *image segmentation*. Secara umum, metode untuk penentuan ambang batas global dapat dikategorikan menjadi parametrik dan non-parametrik. Pada pendekatan parametrik, distribusi tingkat abu-abu dari setiap kelas mempunyai probabilitas fungsi kepadatan yang mengikuti distribusi Gaussian. Pendekatan dengan metode parametrik akan mempekirakan parameter distribusi yang cocok dengan data dari histogram. Kittler and Illingworth (1986) mengusulkan metode thresholding yang mendekati histogram dengan campuran distribusi normal dan meminimalkan kesalahan klasifikasi probabilitas [1]. Zahara,

Fan, and Tsai (2005) mempresentasikan skema pengoptimalan hibrida untuk beberapa ambang dengan kriteria varian minimum dalam kelas Otsu dan pemasangan fungsi Gaussian [2]. Wang, Chung, and Xiong (2008) mengusulkan metode yang berakar pada perkiraan jendela Parzen dari fungsi kepadatan nilai abu-abu yang tidak diketahui. Metode ini dapat mengintegrasikan informasi histogram gambar dengan informasi spasial tentang piksel dari berbagai tingkat abu-abu [3].

Pendekatan non-parametrik akan mencari ambang batas yang memisahkan daerah tingkat abu-abu dari gambar secara optimal berdasarkan kriteria yang membedakan, seperti *between-class variance*, *entropy* and *cross entropy*. Metode yang populer adalah *Otsu's method* (1979), memilih nilai batas ambang dengan memaksimalkan perbedaan nilai antar kelas [4]. Shoo, Soltani, Wong, and Chen (1988) menemukan bahwa metode Otsu lebih baik dalam menentukan ambang batas untuk gambar dunia nyata berkaitan dengan ukuran keseragaman dan bentuk. Namun, formulasi antar-kelas yang tidak efisien dan metode ini memakan waktu yang lama dalam pemilihan ambang atas untuk multi-level [5]. Untuk memecahkan permasalahan ini, Liao, Chen, and Chung (2001) mengusulkan algoritma rekursif yang cepat, *Fast Otsu's method* bersamaan dengan *look-up-table* untuk mengimplementasikan pada *multi-level thresholding* [6]. Ye, Chen, Li, and Zhang (2008) proposed a particle swarm optimization (PSO) algorithm to optimize the Otsus criterion

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Three	Four

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## 5. CONCLUSIONS

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## APPENDIX

Appendixes should appear before the acknowledgment.

## ACKNOWLEDGMENT

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References are important to the reader; therefore, each citation must be complete and correct. If at all possible, references should be commonly available publications.

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