

Chapter 19

Ambiguity Reduction through Optimal Set of Region Selection Using GA and BFO for Handwritten Bangla Character Recognition

Nibaran Das
Jadavpur University, India

Mahantapas Kundu
Jadavpur University, India

Subhadip Basu
Jadavpur University, India

Mita Nasipuri
Jadavpur University, India

ABSTRACT

To recognize different patterns, identification of local regions where the pattern classes differ significantly is an inherent ability of the human cognitive system. This inherent ability of human beings may be imitated in any pattern recognition system by incorporating the ability of locating the regions that contain the maximum discriminating information among the pattern classes. In this chapter, the concept of Genetic Algorithm (GA) and Bacterial Foraging Optimization (BFO) are discussed to identify those regions having maximum discriminating information. The discussion includes the evaluation of the methods on the sample images of handwritten Bangla digit and Basic character, which is a subset of Bangla character set. Different methods of sub-image or local region creation such as random creation or based on the Center of Gravity (CG) of the foreground pixels are also discussed here. Longest run features, extracted from the generated local regions, are used as local feature in the present chapter. Based on these extracted local features, together with global features, the algorithms are applied to search for the optimal set of local regions. The obtained results are higher than that results obtained without optimization on the same data set.

DOI: 10.4018/978-1-4666-8291-7.ch019

INTRODUCTION

For recognizing different patterns identification of local regions where the pattern classes differ significantly is an inherent ability of human cognitive system. This inherent ability of human being may be imitated in any pattern recognition system by incorporating the ability of locating the regions which contain the maximum discriminating information among the pattern classes. The simplest way to do this is to divide the pattern image into a fixed number of equal sized regions. These regions may have some overlap with each other. For each such region, features (often called local features) are extracted. These local regions are then sampled randomly to produce various subsets of them. The recognition performance is evaluated with feature set formed with the local features (for some cases along with some global features) of each of those subsets. The subset, which produces best result, may be considered as an optimal set of local regions where the pattern classes differ significantly. Handwritten character recognition is a typical example of a real world pattern recognition problem which requires huge computation and modelling of perceptual power or cognitive capabilities of human beings, at least to some extent. (Cheriet, El Yacoubi, Fujisawa, Lopresti, & Lorette, 2009). To recognize the handwritten characters, both global and local features jointly or individually are used with a standard classifier. Global features are those features which are extracted from the overall character images. On the other hand, local features are extracted from the sub images of the same.

One of the recent trends for improving the recognition performance of a handwritten character recognition system is to use local features along with global features of the character images. Some works have already been done in the field of handwritten character recognition following the above mentioned principles (Arica & Yarman-Vural, 2001; Basu et al., 2005b, 2009; Cao, Ahmadi, & Shridhar, 1995; Das, Basu, et al., 2009; Due Trier, Jain, & Taxt, 1996; Jaehwa, Govindaraju, & Srihari, 2000; Rajashekararadhy & Ranjan, 2008). In (Rajashekararadhy & Ranjan, 2008), Rajashekararadhy et al. proposed an efficient zone based feature extraction techniques for Handwritten Kanada, Telugu, Tamil, Malayalam numeral recognition. In the paper, they divided the characters into some $M \times N$ zones and average distance features are extracted from the zones. In the paper (Basu et al., 2005b), Basu et al. divided the Bangla digit images into 9 overlapping fixed size sub-images, also termed as windows, interchangeably. From each of these sub-images longest run based features were locally computed. However, a fixed sized window may contain some ambiguous information besides the discriminating one, which may have an adverse effect on the performance of the recognition system. In the paper (Cao et al., 1995) Cao et al. used zone based direction histogram features for recognition of handwritten Roman numerals. The work was primarily motivated by two stage classifier schemes comprising of two different neural networks. To describe different methodologies of offline character recognition systems N. Africa et al (Arica & Yarman-Vural, 2001) cited several feature extraction techniques based on local regions or zones. In the paper (Jaehwa et al., 2000) Jaehwa et al. described a hierarchical feature space based on the zones created by quin tree based zoning scheme. The zones were created dynamically based on the centroids of the contours of the characters. Thus, zones of variable sizes were created for every character of the database. Histogram based gradient and moment based projection features were calculated from those zones in their work. In the approaches (Basu et al., 2009; Das, Basu, et al., 2009), windows of varying sizes were dynamically created on the basis of the centre of gravity (CG) of black pixels of the entire character region and its sub regions (windows) and from each of those regions four longest run features were extracted. Those features along with another set of four longest run features computed globally from the entire character image were used for recognition of Bangla alphabet. The above approach gave

27 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the publisher's webpage:

www.igi-global.com/chapter/ambiguity-reduction-through-optimal-set-of-region-selection-using-ga-and-bfo-for-handwritten-bangla-character-recognition/131264

Related Content

Online Remote Control of a Wireless Home Automation Network

John Wade, Jose Santos and Noel Evans (2009). *International Journal of Ambient Computing and Intelligence* (pp. 39-52).

www.irma-international.org/article/online-remote-control-wireless-home/34034

Query Expansion Using Medical Information Extraction for Improving Information Retrieval in French Medical Domain

Aicha Ghoulam, Fatiha Barigou, Ghalem Belalemand Farid Meziane (2018). *International Journal of Intelligent Information Technologies* (pp. 1-17).

www.irma-international.org/article/query-expansion-using-medical-information-extraction-for-improving-information-retrieval-in-french-medical-domain/204950

Artificial Intelligence Methods and Applications in Aviation

Tetiana Shmelova, Maxim Yatsko, Iurii Sierostanov and Volodymyr Kolotusha (2023). *Handbook of Research on AI Methods and Applications in Computer Engineering* (pp. 108-140).

www.irma-international.org/chapter/artificial-intelligence-methods-and-applications-in-aviation/318062

Fuzzy Logic-Based Cluster Heads Percentage Calculation for Improving the Performance of the LEACH Protocol

Omar Banimelhem, Eyad Taqieddin, Moad Y. Mowafi, Fahed Awad and Feda' Al-Ma'aqbeh (2015). *International Journal of Fuzzy System Applications* (pp. 100-118).

www.irma-international.org/article/fuzzy-logic-based-cluster-heads-percentage-calculation-for-improving-the-performance-of-the-leach-protocol/133128

Exploring Multi-Path Communication in Hybrid Mobile Ad Hoc Networks

Roberto Speicys Cardoso and Mauro Caporuscio (2010). *International Journal of Ambient Computing and Intelligence* (pp. 1-12).

www.irma-international.org/article/exploring-multi-path-communication-hybrid/47173