Clustering and Dynamic Data Visualization with Artificial Flying Insect

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Abstract. We present in this paper a new bio-inspired algorithm that dynamically creates and visualizes groups of data. This algorithm uses the concepts of flying insects that move together in complex manner with simple local rules. Each insect represents one datum. The insect moves aim at creating homogeneous groups of data that evolve together in a 2D environment in order to help the domain expert to understand the underlying class structure of the data set.

1 Introduction

Many clustering algorithms are inspired from biology like genetic algorithms [1, 2] or artificial ant algorithms [3,4] for instance. The main advantages of these algorithms are that they are distributed and they generally do not need an initial partition of data as it can be often needed. This study takes its inspiration from different kinds of animals that use social behavior for their movement (clouds of insects, schooling fishes or bird flocks) that have not been applied and extensively tested on clustering problems yet. Models of these behaviors that can be found in literature are characterized by a "swarm intelligence" which consists in the appearance of macroscopic patterns obtained with simple entities obeying to simple local coordination rules [6,5].

2 Principle

In this work, we use the notion of flying insect/entity in order to treat dynamic visualization and data clustering problems. The main idea is to consider that insects represent data to cluster and that they move following local behavior rule in a way that, after few movements, homogeneous insect clusters appear and move together. Cluster visualization allow the domain expert to perceive

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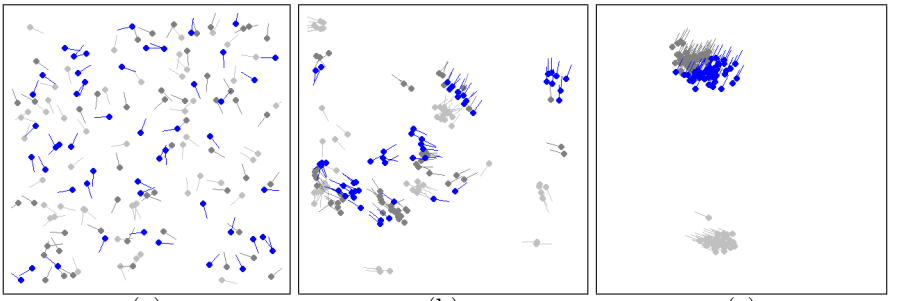
the partitioning of the data. Another algorithm can analyze these clusters and give precise classification as output.

An example can be observed in the following pictures :



(a) (b) (c)

where (a) corresponds to the initial step for 150 objects (Iris dataset), (b) and (c) are screen shots showing the dynamic formation of clusters.

3 Conclusion

This work has demonstrated that flying animals can be used to visualize data structure in a dynamic way. Future work will concerns an application of these principles to present results obtained by a search engine.

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