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Computing Solutions inspired in Biology

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1. Introducción

Nature has innovated, created, validated, improved and diversified systems of living beings from thousands of years ago. In particular, the man has always characterized by a constant search for new ways to improve their living conditions in order to reduce the effort for certain activities related to the work. One of the ways to reduce the effort is through the creation of bio-inspired computing solutions in the science of life or biology.

Bio-inspired systems have emerged as a set of models that are based on the behaviour and how to act in certain biological systems to solve problems of various industries. Bio-inspired computational biology solutions are based on areas related to artificial intelligence, data mining, research of operations, among others.

Solutions (algorithms) computational bio-inspired by biology are based on areas related to artificial intelligence, data mining, research of operations, among others. A bio-inspired algorithm is that computational solution inspired by biology or life science. Bio-inspired algorithms mimic the behaviour of swarms of insects and zooplankton swarms, flocks of birds of different species, schools of fish of different species, and herds of mammals.

2. Computing Solutions inspired in Biology

The swarm algorithm refers to any algorithm that models the grouping for the social behaviour of swarms of insects and zooplankton. The swarm is a social group (of the same species) of insects and marine zooplankton. There are several types of swarms, two of the best known are insect swarms and swarms of marine zooplankton.

A. Insect swarms consist of the following insects: bees, honey bees Africanized, ants, termites, locusts, flies, mosquitoes, flies, fly African Nile River, pine, ladybug, aphids, beetles butterflies monarchs, bumble bees, fire, Warrior ants, ants, and others).
B. Swarms of marine zooplankton comprise the animal organism called zooplankton (copepods, mysids, segetids, Scyphomedusae, and others). Swarm algorithms are inspired by insect swarms and swarms of zooplankton. Some of the most popular swarms algorithms are: the Ant Colony optimization algorithm was inspired by research on the behavior of ant colonies,

Firefly algorithm is based on insects called fireflies, the optimization of the marriage of the honey bee algorithm is inspired by the process of reproduction of honey bee artificial bee colony algorithm is based on the collection of honey bees, wasps swarm algorithm was inspired by the Parasitárias of the wasps, algorithm termite, the algorithm of swarm of mosquitoes, the swarm of zooplankton algorithm and algorithm of swarm of bumblebees.

Some of the most popular swarms algorithms are: The Ant Colony algorithms (Ant Colony Optimization ACO), initially proposed by Marco Dorigo [1], were inspired by the behaviour of a colony of ants to collect their food. The ants initially made the search for food in a random manner and to find it returning to the colony, leaving a trail of pheromones (chemicals that produce the ants), if other ants find the trail of pheromones they no longer find randomly and follow the trail of pheromones (and reinforce the trail of pheromones) until you reach the food. When found food, ants leave put the trail of pheromones and the essence disappears slowly. Fireflies algorithms (Firefly algorithm), initially proposed by Yang [2], were inspired by the most common insects called fireflies. Fireflies are characterised by their ability to emit light (bioluminescence) to attract couples of the opposite sex and to prevent certain animals to eat them. The Firefly algorithm consists of: all the fireflies are unisex and they are attracted to another depending on the sex (if he is male, unisex becomes female), attraction is proportional to the amount of brightness, and brightness is affected by the objective function of the algorithm.

Algorithms of artificial bees (Artificial Bee Colony Algorithm ABC), initially proposed by Karaboga and Basturk [3], are inspired by the process of the collection of bees. Harvesting honey bees are distinguished mainly by produce and store honey. Bees make movements to share the location information of the deposit of pollen and nectar through a dance that takes place following a number eight. The distance and speed of their movements communicate the distance of the location of the tank. To share the address of deposit dance must have an angle in relation to the Sun which determines the angle of direction with respect to the honeycomb of the deposit. Algorithms of swarm of mosquitoes. Mosquito swarm algorithms were initially proposed by Ruiz-Vanoye & Diaz-Parra and others [4] and are based on a group of mosquitoes social behavior. Mosquitoes have sensors designed to track their prey: A) sensors chemicals, mosquitoes can detect the carbon dioxide and lactic acid up to 36 meters of distance. Mammals and birds emit these gases as part of your normal breathing. Certain chemicals in sweat also seem to attract mosquitoes. (B) Heat, mosquito's sensors can detect heat, so it can be found mammals warm-blooded and birds very easily once you are close enough. A swarm of mosquitoes that exist close to areas with stagnant water.

The algorithm of fish refers to any algorithm that model the grouping of schools of fish through the social behaviour. The school of fish is a social group (of the same species) of fish and marine animals. The shoal of fish has the characteristic that they are groups of individuals involved in movements consistent with the parallel orientation, the presence or absence of this parallel orientation distinguishes swarms fish stock. Schools of fish are characterized by a synchronized swimming of fish at the same speed and in the same direction, usually of the same species and the same age and/or size. Fish banks consist of the following fish and marine animals: sardines, salmon, Barracuda, spiny fish, European fish, krill, jellyfish, and others. Shoals of fish algorithms are inspired by the synchronized movements of fish at the same speed and same direction of the fish. Some of the most popular algorithms of shoals of fish are as follows: the Particle Swarm Optimization algorithm was inspired by the social behaviour and the dynamics of the movement of fish.

The flock algorithm refers to any algorithm which models the grouping of birds of the social behaviour. A flock is a social group (of the same species) birds. Synchronized Flying Flock is behaviour coordinated large groups of birds (of the same species) to fly at the same speed and in the same direction. There may be a fundamental difference between the synchronized movements of banks of fish and synchronized flight of

flocks, the synchronized swimming fish are reacting individuals more or less to its immediate neighbours, due to the limitation in view, while the in-flight synchronized of the flocks of birds, individuals are able to see a part of the movement of the flock of birds. The flocks of birds consist of the following animals: Dunlin, starlings, ducks, geese, pelicans, crows, flamingos, parrots, gulls, pigeons, parrots and others). Flock algorithms are inspired by the flock or flocks of birds. Some of the most popular flock algorithms are: Flock algorithm and the three rules of flocks of Reynolds (flock centering or cohesion, to avoid collisions or separation and is approaching or alignment), the Particle Swarm Optimization algorithm was inspired by the social behaviour and the dynamics of movement of poultry.

Some of the most popular algorithms are: The algorithms of optimization of the swarm of particles (Particle Swarm Optimization PSO), was initially proposed by Kennedy and Eberhart [5], they were inspired by the social behaviour and dynamic movements of birds and fish. The birds and the fish adjust their physical movements to avoid predators, find food and couples improve their temperatures, among other aspects. PSO algorithms are algorithms of machine learning that uses particles as agents who fly in a search space and evaluate performance based on a functional target.

The term algorithm herd and algorithm Pack refer to any algorithm that models of the grouping of the herds of mammals and packs for the social behaviour. The herd is a social group (of the same species) of the mammals. Large groups of social grouping of carnivores are called packs. Herds are composed of the following animals: African wild dogs, grey wolves, jackals, Ethiopian wolf, wild dogs, bats, buffalos, zebras, bison, sheep, sheep, elephants, wolves, feral dogs, pigs, wild horses, rhinos, wildebeest, llamas, giraffes, antelopes (antelope, the Thompson Gazelle, impalas), whales, dolphins, rats and others. Algorithms of herds and packs algorithms are inspired on herds of mammals and packs. Some of the herds most popular algorithms are: algorithm of bats, Wolf search algorithm, algorithm of a herd of rats, a pod of dolphins algorithm, and the algorithm of a herd of feral dogs.

Some of the most representative algorithms are: The Bats Algorithms developed by Xin-She Yang [2], are inspired by the biological behaviour of the echolocation of bats. Bats perform a biological behavior called echolocation which enables them to detect obstacles, communicate among themselves as well as to find food. During echolocation bat emits a series of sounds that travel bouncing on objects and surfaces in their way which creates an echo. ECHO is returned to the bat giving it a three-dimensional notion of what is in your way (dam or barrier). The bat or its echolocation call uses frequencies between 14 000 to 100 000 Hz (the human ear listening between 20 Hz, 20 000 Hz). The Algorithms herds of dolphins. Dolphin algorithms were initially proposed by Ruiz-Vanoye & Diaz-Parra and others [4] and are based on the behaviour of a group of dolphins. The dolphins live in herds from a dozen to more than 1,000 dolphins in places with an abundance of food. Dolphins communicate using a variety of clicks, whistles, sounds and vocalizations, like others and exchange between groups is common. The Dolphin looks for food using echolocation (direct clicks into the water and listen to the intensity of the echo bounced this know the distance from the origin to the object). Echolocation is a process in which a dolphin emits a constant series clicks in fractions of a second (pulses repeated 800 times per second ultrasonic sound).

CONCLUSIONS

The main techniques, algorithms, or computational methods obtained imitating the behaviour of human beings in nature used to provide a solution to problems of different areas and industries were commented on in this article. But are in discussing the following questions: what else is it possible to imitate to give a computational solution to the problems of everyday life? What else is it possible to imitate to give a solution to society's problems? What else is it possible to imitate to give a solution of technological innovation?

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