CSE 598 - Bio-inspired AI & Optimisation
Final Project - Proposal - Wolf Pack Algorithm

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The algorithm of choice is wolf pack algorithm which is a global optimisation. Global optimisation is a necessary tool to have with wide range of applications in many areas, like in science, economy, engineering etc. In complex societies it is imperative to have solutions that or fast and lesser in time complexity. Increase in complexity of many real-world problems over time makes global optimisation a challenging task, especially using traditional methods. Inspired by nature some researchers have search for cues in nature to tackle these impending problems. There are many swarm intelligence phenomenon in nature. Scientist and naturalists got their attention piqued by the remarkable social and swarm behaviour of animals and human alike such as swarming ants, schooling fish, and flocking birds. One such behaviour is exhibited by wolf packs. Researchers saw that Hunting for food in packs yields are higher capturing rate than one animal striving for food. This principle is used in searching and swarm optimisation. The algorithm works in the following steps -

- Initialisation: Firstly, there is a lead wolf, the smartest and most ferocious in the pack, selected by natural selection. The centre of the class that is where the lead wolf lies. Initialise the necessary parameters, like number of wolves, positions of wolves, maximum number of iterations, maximum number of scouting repetitions, step coefficient, distance determinant coefficient, population renewing proportional coefficient etc.

- Scouting: After choosing the fittest wolf to be the lead wolf, the rest of the wolves take scouting behaviour and search the solution space, until either one of the wolves find a better solution than the lead wolf, or until maximum number of repetitions is reached.

- Calling: The wolf that is closer to the optimal solution is now assigned the new lead wolf, who calls the rest of the pack towards its position. All the wolves gather towards the lead wolf fast, until either a different wolf finds a better solution on the way. The algorithm designs how much distance it should travel from the lead wolf.

- Besieging: All the wolves who reach the specific distance from the lead wolf now stop and take Besieging behaviour. The algorithm locates itself as if to surround the pray.

- Renew the position of lead wolf: Lead wolf finds the optimal solution in this localized space that contains the global optimum, and the position of lead wolf is updated according to winner-take-all rule.

- Renew wolf pack: Wolf pack is updated under the population renewing rule.

- Termination: If the solution matches the precision requirement or if the maximum number of iterations is reached, the program terminates and outputs the optimal solution. Else the program goes back to Scouting.

The baseline algorithm that we are going to implement will be the Wolf Pack Algorithm, as described by the above section.

Dataset & Experimentation - The points in our dataset will comprise of ten “wolves”, each of which represents the value of a function with different parameters. The functions that will be used to evaluate the algorithm are

- Rosenbrock function
- Sphere function
- Sum-squares function
- Booth function
- Ackley function

Metrics - Evaluation metric of choice for our project is going to be calculating the error in expected and produced value. Also, the graphs of the path taken by each wolf and where they end up converge will be plotted.

Thank you