

Finding the optimal solution efficiently

Physically inspired algorithms have the potential to find solutions of problems efficiently

Techniques for constructing 3D models of objects by only using images have long been present. Reconstructing 3D models require using algorithms. The purpose of these algorithms is to find the best reconstruction possible. However, all the algorithms that have been used for reconstruction have the need to use mathematical tools to find the best reconstruction. These mathematical tools need computing power which increases the time needed to find the best reconstruction.

Over the past ten years, there has been development in finding algorithms that are physically inspired. A benefit of using physically inspired algorithms is that they do not need to use mathematical tools to solve problems. One such algorithm that has found a lot of applications is known as particle swarm optimization or simply PSO. As the name suggests PSO uses a bunch of particles that try to find the best reconstruction. The special attribute of these particles are that they can communicate with each other, evaluate their positions and compare their current position to their previous best position. This means that particles have social and cognitive behaviour. The inspiration behind this algorithm was a flock of birds trying to find food on a field (the physically inspired part).

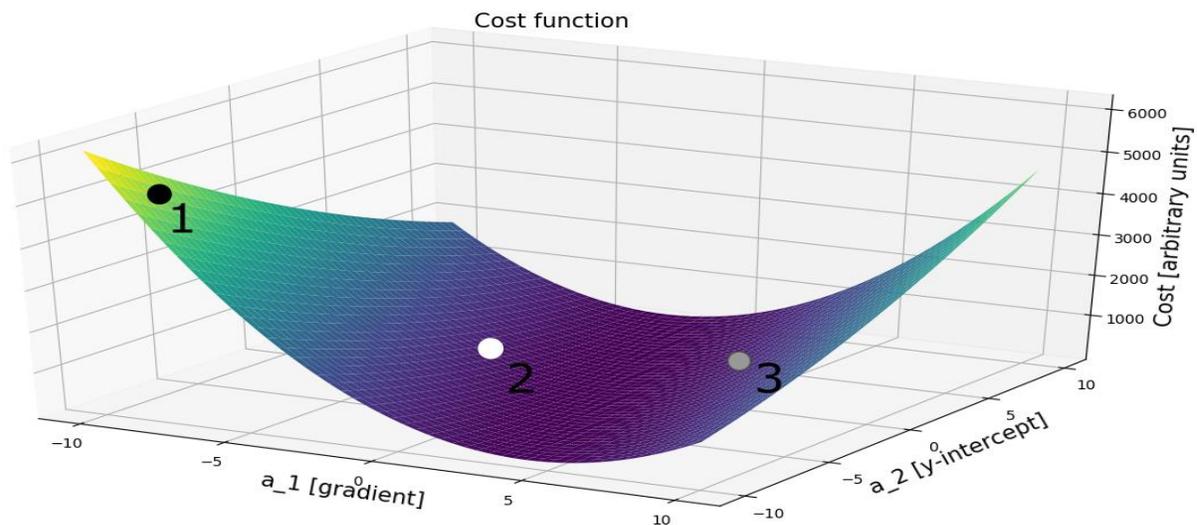


Figure 1 The particles can be viewed as a Flock of birds finding food. The food is located at the lowest point of the coloured landscape.

To use an analogy to understand how PSO works. Imagine a hilly terrain with lots of peaks and troughs where food is present in the troughs. The amount of food will depend on the depth of the troughs: the deeper the trough, the more food present. Suppose, two birds are roaming around this terrain. They obviously want to find food! Bird 1 goes to a trough and finds some food. Bird 1 knows it is in a good position (this is the cognitive behavior). Then bird 1 signals to bird 2 what it has found. Bird 2 wants some piece of that food, so it starts walking towards the general direction of bird 1 (this is the social behavior). On its way, it passes through a trough that

has much more food than the trough bird 1 is in. Bird 2 signals what it has found to bird 1. After some time, both of the birds unite and enjoy the food together.

In my research I am going to benchmark three algorithms on two problems. Two of the algorithms are physically inspired and gradient-less (PSO and Nelder-Mead) while the third one is a gradient based algorithm known as Levenberg-Marquardt. This will be done to determine whether there are any advantages.