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TITLE: THE EFFECT OF CLIMATE CHANGES ON STANDARD DE AND ANCDE

Abstract – Artificial Intelligent (A.I) is one aspect of computer science. It draws an understanding of the brain from neuroscience and the mathematics of information theory. The main concern of A.I is to solve problems with system that operate or act intelligently. One of the inspirations of A.I is biological metaphor, which leads to a category called Evolutionary Computation. Evolutionary Computation is motivated by the neo-Darwinian theory of evolution. One of its methods is Differential Evolution, introduced by Storn and Price in 1995. Differential Evolution has become popular because of its simple method of implementation. Besides that, Differential Evolution has been proved as one of the most reliable algorithms in dealing with optimization problems. Differential Evolution is been used in global optimization problems such as in engineering, statistic and finance. A basic variant of the DE algorithm works by having a population of candidate solutions (called agents). These agents are moved around in the search-space by using simple mathematical formulae to combine the positions of existing agents from the population. If the new position (called donor vector) of an agent is an improvement it is accepted and forms part of the population, (by comparing the donor vector with the trial vector) otherwise the new position is simply discarded. The process is repeated until it reaches the stopping criteria. The process contains *initialisation*, *mutation*, *recombination*, and *crossover*.

Differential Evolution is still open for modification of improvement. Since Differential Evolution is depending on its population in order to select the target vector, producing a variety of sources to the main population might have the ability to improve the fitness vector of each individual in the population. The source may come from the ancestor template of the current generation. Lolle et al stated that *Arabidopsis* plant is transferring genetic information from grandparents to the current individual. The purpose of transferring genetic information is to modify the invalid genes of the current plants. Here came the AncDE that do modification involves the differences vector and the information that is used to form that vector. AncDE introduced a second shadow population of archived ancestor vectors, which are updated stochastically and use this population of ancestor vectors when generating donor vectors. There are two parameters introduced in AncDE to control the ancestor upon current population; ancestor usage probability (*aup*) and ancestor replacement probability (*arp*). The purpose of ancestor usage probability (*aup*) is to give influence to the frequency ancestor, which is used to calculate difference vector. While, the ancestor replacement probability (*arp*) control the age of the ancestral population.

On the other hand, climate change is another factor that give effect on the population growth; human, animals or plants. In *Arabidopsis* plant case; it has been proved that its can survived due the climate change which is reflecting to the research done Brown University researchers (2011). Recently we are working on the climate changes effects for both DE and AncDE. The climate changes would have two magnitudes: hot climate and cold climate. We would like to analyze how quickly the population is recovering from hot to cold or vice versa by calculate the distance between climate changes with the event for both DE and AncDE. From the distance we can measure how long the ancestor template reaches the optimum. Our hypothesis is ancestor template in AncDE would recover the genotype faster than DE. We would apply additional value call magnitude $\boldsymbol{\epsilon}$ with the fitness function $f(x_i)$. The climate changes magnitude would be randomly 5% of the max $\boldsymbol{x}$ to present hot climate and another randomly 5% from minimum $\boldsymbol{x}$ to present cold climate. We also would like to define at what degree the ancestor template best recover from the climate changes. The climate event only occurs at several generations for example at 50^{th}, 100^{th}, 150^{th}, 200^{th} and 250^{th} generation. For this time being, we are implementing this method over 4 different functions (DeJong1, Dejong2, Rastrigin, Ackley). DE and AncDE will apply best replacement and binomial exponential.