

**Zain Ali– 16L-4066**

**Usama Ali– 15L-4187**



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**Artificial Intelligence**

**Bachelor of Computer Science**

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**Course Instructor;**

**Dr. Usman Awais**

**National University of Computer and Emerging Sciences – LHR**

***[1]***[***A Fast Elitist Non-Dominated Sorting Genetic Algorithm for Multi-Objective Optimization: NSGA-II***](https://link.springer.com/chapter/10.1007/3-540-45356-3_83)

***Study Related to:***

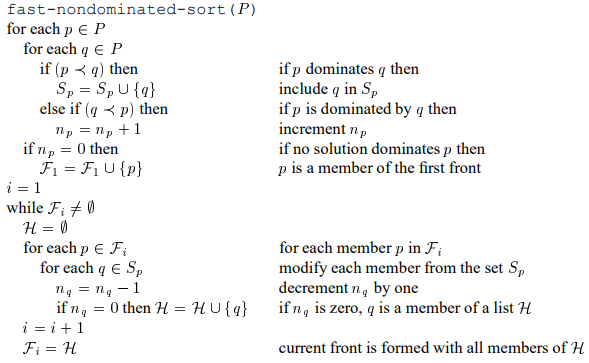
* To examine Multi objective evolutionary algorithms
* To prove how Non dominated Sorting Genetic Algorithm(NSGA-2) for Multi-Objective Optimization is better and faster than previously suggested algorithms

***Claim of Paper:***

Multi-objective evolutionary algorithms which use non-dominated sorting and sharing have been fundamentally censured for their (a) O(mN3) computational unpredictability (where m is the quantity of targets and N is the populace estimate), (b) non-elitism approach, and (c) the requirement for indicating a sharing parameter. In this paper, we propose a non-overwhelmed arranging based multi-objective developmental calculation (we considered it the Non-commanded Arranging GA-II or NSGA-II) which eases all the over three challenges. In particular, a quick non-ruled arranging approach with O(mN2) computational multifaceted nature is displayed. Second, a choice administrator is displayed which makes a mating pool by joining the parent and youngster populaces and choosing the best (as for wellness and spread) N solutions.

***Proof of Claim:***

Simulation results on five difficult test problems show that the proposed NSGA-II is able to find much better spread of solutions in all problems compared to PAES—another elitist multi-objective EA which pays special attention towards creating a diverse Pareto-optimal front.

The fast non-dominated sorting procedure which when applied on a population P returns a list of the non-dominated fronts F.

Because of NSGA-II’s low computational requirements, elitist approach, and parameter-less sharing approach, NSGA-II should find increasing applications in the years to come.

***Opinion:***

If you consider my opinion or perspective after reading this article, I have concluded that with the properties of a quick non-commanded arranging strategy, an elitist methodology, and a parameter less methodology, NSGA-II should discover expanding consideration what's more, applications sooner rather than later.

***[2]*** ***A COPMARISON OF PARTICLE SWARM OPTIMIZATION AND THE GENETIC ALGORITHM***

***Study Related to:***

* To examine Particle Swarm optimization
* To discuss how PSO is better than GA in terms of computational efficiency Although both are search methods

***Claim of Paper:***

Particle Swarm Improvement (PSO) is a moderately late heuristic pursuit strategy that depends on the possibility of community oriented conduct and swarming in natural populaces. PSO is like the Hereditary Calculation (GA) in the sense that they are both populace based hunt approaches and that the two of them rely upon data sharing among their populace individuals to improve their hunt forms utilizing a mix of deterministic and probabilistic guidelines. Then again, the GA is a settled calculation with numerous variants and numerous applications. The target of this examination is to test the theory that expresses that despite the fact that PSO and the GA by and large yield the same adequacy (arrangement quality), PSO is all the more computationally proficient (utilizes less number of capacity assessments) than the GA.

***Proof of Claim:***

To explore this case, two factual tests were set to look at the two components of this guarantee, equivalent viability yet better proficiency for PSO over the GA. To carry out the t-tests, eight sample test problems were solved using both PSO and the GA over multiple runs. The test problems includes three well-known benchmark test problems; these are: the Banana (Rosenbrock function, the Eggcrate Function, and Golinski’s Speed Reducer. Two space systems design problems were also investigated to test the algorithms on real-life engineering problems. The first problem is the configuration of a ground-based multistation radio telescope array. Four versions of this problem were investigated including 5, 6, 7 and 8-station arrays. The second test problem involves the reliability-based design of a commercial communication satellite. All test problems involve continuous design variables only except for the satellite design

Two metrics were identified for the two t-tests. The effectiveness test for both PSO and the GA uses a quality of solution metric that measures the normalized difference between the solutions obtained by the heuristic approaches and known solutions of the test problems. The efficiency test uses the number of function evaluations needed by the heuristic approaches to reach convergence. The same convergence criterion is enforced on PSO and the GA.

The results of the t-tests support the hypothesis that while both PSO and the GA obtain high quality solutions, with quality indices of 99% or more with a 99% confidence level for most test problems, the computational effort American Institute of Aeronautics and Astronautics 13 required by PSO to arrive to such high quality solutions is less than the effort required to arrive at the same high quality solutions by the GA.

***Opinion:***

If you consider my opinion or perspective after reading this article, I have concluded that although both are search methods but our work can be done in less cost with PSO over GA. Further analysis shows that the difference in computational effort between PSO and the GA is problem dependent. It appears that PSO outperforms the GA with a larger differential in computational efficiency when used to solve unconstrained nonlinear problems with continuous design variables and less efficiency differential when applied to constrained nonlinear problems with continuous or discrete design variables.

***[3] An Orthogonal Genetic Algorithm with Quantization for Global Numerical Optimization***

***Study Related to:***

* To examine Orthogonal Genetic Algorithm
* To discuss how Orthogonal Genetic Algorithm can be improved by using quantization technique.

***Claim of Paper:***

A genetic algorithm called the orthogonal genetic algorithm with quantization for worldwide numerical optimization with persistent factors was designed. Our goal is to apply techniques for trial configuration to upgrade the hereditary calculation, so the subsequent calculation can be progressively strong and factually solid. A quantization procedure is proposed to supplement an experi-mental structure strategy called symmetrical plan. We apply the resulting approach to produce an underlying populace of focuses that are dispersed consistently over the attainable arrangement space, with the goal that the calculation can equally examine the achievable arrangement space once to lo-cate great focuses for further investigation in ensuing emphasess. Also, we apply the quantization system and symmetrical plan to tailor another hybrid administrator, with the end goal that this hybrid administrator can create a little, however agent test of focuses as the potential posterity.

***Proof of Claim:***

To proof their claim, the resulting methodology to generate an initial population of points that are scattered uniformly over the feasible solution space, so that the algorithm can evenly scan the feasible solution space once to lo- cate good points for further exploration in subsequent iterations. In addition, we apply the quantization technique and orthogonal design to tailor a new crossover operator, such that this crossover operator can generate a small, but representative sample of points as the potential offspring. We execute the proposed calculation to tackle 15 benchmark issues with 30 or 100 measurements and expansive quantities of nearby minima. The outcomes demonstrate that the proposed calculation can discover ideal or near ideal arrangements.

50 independent runs for each algorithm on each test function are performed and recorded:

1) the mean number of func- tion evaluations,

2) the mean function value (i.e., the mean of the function values found in the 50 runs),

3) the standard deviation of the function values.

We see that the mean function values are equal or close to the optimal ones, and the standard deviations of the function values are relatively small.

***Opinion:***

If you consider my opinion or perspective after reading this article, I have concluded that OGA/Q can find optimal or close-to-optimal solutions, and it is more competitive than five recent algorithms on the problems studied in article but every time these techniques will not work.

***[4]*** ***The Compact Genetic Algorithm***

***Study Related to:***

* To examine Compact Genetic Algoithm
* To discuss how CGA is better than GA

***Claim of Paper:***

This paper presents the compact genetic algorithm (cGA) which speaks to the populace as a likelihood dissemination over the arrangement of arrangements and is operationally comparable to the request one conduct of the basic GA with uniform hybrid. It forms every quality freely and requires less memory than the basic GA. The improvement of the smaller GA is guided by a legitimate comprehension of the job of the GA's parameters furthermore, administrators. The paper obviously represents the mapping of the basic GA's parameters into those of a comparable conservative GA. PC reproductions look at the two calculations in wording of arrangement quality and speed

***Proof of Claim:***

The structure of the reduced GA was clarified, also, computational tests showed the surmised equality of the minimal GA with a basic GA utilizing uniform hybrid. In spite of the fact that the minimal GA around mirrors the orderone conduct of the basic GA with uniform hybrid, it isn't a trade for the straightforward GA. Basic GA's can perform very well when the client has some information about the nonlinearities in the issue. All things considered, the structure squares can be firmly coded and they can be spread all through the populace through the rehashed activity of choice and recombination. Note that as a rule, this linkage data isn't known. In many applications, be that as it may, the GA client has some learning about the issue's area and tends to code together in the chromosome includes that are by one way or another spatially related in the first issue. As it were, the GA client has halfway learning about the linkage. This is most likely one of the principle reasons why basic GA's have had to such an extent accomplishment in genuine applications. Obviously, once in a while the client think he has a decent coding, when in actuality he doesn't. In such cases, basic GA's are probably going to perform inadequately. At long last, and most critical, this investigation has presented new thoughts that have imperative repercussions for GA structure. By taking a gander at the basic GA from an alternate point of view, we become familiar with its unpredictable elements and opened new entryways toward the objective of having progressively productive GA's First it focuses on the most noteworthy bits and after that, once those bits have combined, it proceeds onward to next generally critical bits. For this capacity, the arrangement quality is estimated by the number of sequential bits settled effectively

***Opinion:***

If you consider my opinion or perspective after reading this article, I have concluded CGA is better than GA in some conditions but it has both advantages and disadvantages so it depends on ourself to use it or not.

***[5]*** ***A Hybrid of Genetic Algorithm and Particle Swarm Optimization for Recurrent Network Design***

***Study Related to:***

* To examine Particle sworm Optimization
* To discuss Genetic Algorithm for Recurrent network design

***Claim of Paper:***

A evolutionary recurrent network which mechanizes the plan of intermittent neural/fluffy systems utilizing another developmental learning calculation is proposed in this paper. This new developmental learning calculation depends on a cross breed of hereditary calculation (GA) and molecule swarm streamlining (PSO), and is along these lines called HGAPSO. In HGAPSO, people in another age are made, not just by hybrid and change task as in GA, yet additionally by PSO. The idea of tip top methodology is received in HGAPSO, where the upper-portion of the best-performing people in a populace are viewed as elites. Nonetheless, rather than being duplicated straightforwardly to the people to come, these elites are first improved.

***Proof of Claim:***

The group established by the elites is viewed as a swarm, and every tip top relates to a molecule inside it. In such manner, the elites are upgraded by PSO, an activity which imitates the developing wonder in nature. These upgraded elites comprise half of the populace in the new age, though the other half is created by performing hybrid and change task on these improved elites. HGAPSO is connected to repetitive neural/fluffy system configuration as pursues. For intermittent neural system, a completely associated repetitive neural system is structured and connected to a worldly grouping generation issue. For repetitive fluffy system structure, a Takagi– Sugeno– Kang-type intermittent fluffy system is planned and connected to dynamic plant control.

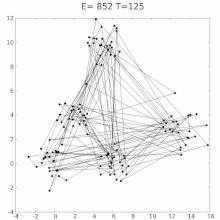
***Opinion:***

If you consider my opinion or perspective after reading this article, the performance of HGAPSO is compared to both GA and PSO in these recurrent networks design problems, demonstrating its superiority.

***Simulated Annealing***

**A** method for solving unconstrained and bound-constrained optimization problems. The method models the physical process of heating a material and then slowly lowering the temperature to decrease defects, thus minimizing the system energy.

**It** is a [probabilistic technique](https://en.wikipedia.org/wiki/Probabilistic_algorithm) for approximating the [global optimum](https://en.wikipedia.org/wiki/Global_optimum) of a given [function](https://en.wikipedia.org/wiki/Function_(mathematics)). Specifically, it is a [Meta heuristic](https://en.wikipedia.org/wiki/Metaheuristic) to approximate [global optimization](https://en.wikipedia.org/wiki/Global_optimization) in a large [search space](https://en.wikipedia.org/wiki/Solution_space) for an [optimization problem](https://en.wikipedia.org/wiki/Optimization_problem). It is often used when the search space is discrete (e.g., all tours that visit a given set of cities). For problems where finding an approximate global optimum is more important than finding a precise local optimum in a fixed amount of time, simulated annealing may be preferable to alternatives such as [gradient descent](https://en.wikipedia.org/wiki/Gradient_descent).



***Pseudo code:***

* Let *s* = *s*0
* For *k* = 0 through *k*max (exclusive):
  + *T* ← temperature(*k* ∕ *k*max)
  + Pick a random neighbor, *s*new ← neighbor(*s*)
  + If *P*(*E*(*s*), *E*(*s*new), *T*) ≥ random(0, 1):
    - *s* ← *s*new
* Output: the final state *s*

***[6] Adaptive simulated annealing (ASA): Lessons learned (2000)748***

***Study Related to:***

* Adaptive simulated annealing (ASA) is a global optimization algorithm that relies on randomly importance-sampling the parameter space, i.e., in contrast to utilizing deterministic approaches often used by OR and mathematical programming people.
* This paper deals with some of the lessons learned from this interaction. I think that at least some of these lessons may be useful to other developers of simulated annealing (SA) code, as well as to many users.

***Claim of Paper:***

* Adaptive simulated annealing (ASA) is a global optimization algorithm based on an associated proof that the parameter space can be sampled much more efficiently than by using other previous simulated annealing algorithms.

***Proof of Claim:***

* The proof is given that using C language has its advantage over other languages as recursive calls are easier to implement and proved as a basis for the speed and efficiency of ASA.

***Opinion:***

* The proof given by the author is plausible.

***[7] Simulated Annealing for Complex Portfolio Selection Problems (2001)346***

***Study Related to:***

* This paper describes the application of a simulated annealing approach to the solution of a complex portfolio selection model.

***Claim of Paper:***

* The model is a mixed integer quadratic programming problem which arises when Markowitz' classical mean-variance model is enriched with additional realistic constraints.
* Exact optimization algorithms run into decultures in this framework and this motivates the investigation of heuristic techniques.

***Proof of Claim:***

* The author has provided credible proof by proposing solutions for each constraint problem by explicitly restricting the portfolios to remain in the feasible region or by penalizing infeasible portfolios.

***Opinion:***

* The proof given by the author is plausible.

***[8] A simulated annealing approach to define the genetic structure of populations (2002)1619***

***Study Related to:***

* We present a new approach for defining groups of populations that are geographically homogeneous and maximally differentiated from each other.
* As a by-product, it also leads to the identification of genetic barriers between these groups.
* The method is based on a simulated annealing procedure that aims to maximize the proportion of total genetic variance due to differences between groups of populations (spatial analysis of molecular variance).

***Claim of Paper:***

* The purpose of this document is to find population or datasets that are homogeneous to one another but have different maximal values.

***Proof of Claim:***

* The proof given is that for multiple runs of different algorithms, each algorithm has benefits over the other. The SOMOVA algorithm finds maximally different groups, whereas the Monomier algorithm is better at finding genetic barriers.

***Opinion:***

* The proof given by the author is plausible.

***[9] A survey of simulated annealing as a tool for single and multi-objective optimization (2006)499***

***Study Related to:***

* We propose a new approach which indirectly detects genetic barriers in a sampling region but is especially designed to define groups of populations without the need for interpolation.

***Claim of Paper:***

* When the sampling points are not regularly spaced in the region under study, the interpolation process leading to continuous allele frequency surfaces can sometimes introduce artefactual discontinuities (Sokalet al. 1999).
* In fact, our approach consists of defining groups of populations that are maximally differentiated from each other (i.e. those for which the proportion of total genetic variance due to differences between groups is maximum).
* As a by-product, these groups are separated from each other by a genetic barrier. In contrast to classical tests of genetic structure, in which groups of populations are defined a priori on the basis of physical, ecological, linguistic or cultural characters, our method enables one to find a group structure based solely on genetic data.
* Our approach is similar in spirit to that implemented in the program structure proposed by Pritchard et al. (2000), which is a Bayesian clustering approach to assign individuals to populations.

***Proof of Claim:***

* Their model assumes Hardy Weinberg and linkage equilibria and attempts to define groups of individuals that minimize departures from these equilibria. In our case, a higher hierarchical level is considered: instead of defining groups of individuals, our goal is to define groups of populations.
* we assign populations to groups with the constraint that they must be geographically adjacent and genetically homogeneous. Our approach also differs in that it can be applied to both genotypic and haplotypic data, and it makes no assumptions about Hardy Weinberg equilibrium within populations, or about the linkage equilibrium between loci.

***Opinion:***

* The proof given by the author is plausible.

***[10] Lévy Flights, Non-local Search and Simulated Annealing (2007)401***

***Study Related to:***

* This article is written to solve a problem of non-convex stochastic optimization by using simulated annealing of Levy flights of a variable stability index.
* This is used to determine the global minimum of an unknown potential U.

***Claim of Paper:***

* The experiment was performed on cool down Levy flights, Levy flights with stable-like process, one-well dynamics.
* The experiment was run for non-local random search. For the non-local random search, the global minimum was searched, the local minimum with maximal energy was searched, a local minimum with certain energy.

***Proof of Claim:***

* If a(x) is chosen in an appropriate way, the levy particle settles in a neighborhood of global minimum of U. The non-constant behavior of the stability index is crucial for the success of the search. This process has an advantage over Gaussian simulated annealing. The probability to jump into the deepest well is maximal. The temperature decreases polynomial fast in time and not logarithmic. The accuracy is significantly increased for finding local minima. This experiment is based on the approximation and estimation of the optimal a(x) and which minimizes the search time.

***Opinion:***

* The proof given by the author is plausible.

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