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# COMPARISON ON TWO WELL KNOWN TECHNIQUES FOR CHARACTER RECOGNITION

Survey paper

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## ABSTRACT

*Character Identification is Offline-Handwriting Recognition that is enables a person to write something text on a piece of paper and identify each text or letter from written text. Character may be written in different styles by different person. So, there are enumerable styles in which character may be written. If we combined two styles then it generates new different writing style. But create new form of writing style is problem that is solved by computational method. Here we choose Particle swarm optimization which is applied in recognition part of the system. In this paper we compare two different algorithms that is Genetic algorithm and Particle swarm optimization & their work on image field by the help of their result.*

***Keywords: Particle swarm optimization; Genetic algorithm; Character recognition.***

## I. INTRODUCTION

Character Identification refers to identification of hand written characters and printed characters. Character detection, extraction and recognition have been an active field of research for many years. It still remains an open problem in the field of Pattern Recognition and Image Processing. The problem can be viewed to classify most appropriate character to the given figure. There are mainly three phases of a character recognition system: Preprocessing, Segmentation, Recognition. The preprocessing technique such as noise removal etc. aims to irrelevant and unwanted data. In Recognition module, system has to recognize the object in predefined way [1] [2].

Various techniques are available in literature for character recognition. This paper compares two well known with their advantages and disadvantages.

Rest of the paper is organized as follow:

Section II describes the principle of PSO, Genetic Algorithm & their comparison. Implementation of techniques is in section III. Results of the techniques are indicated in section IV. Finally, section V consists of results.

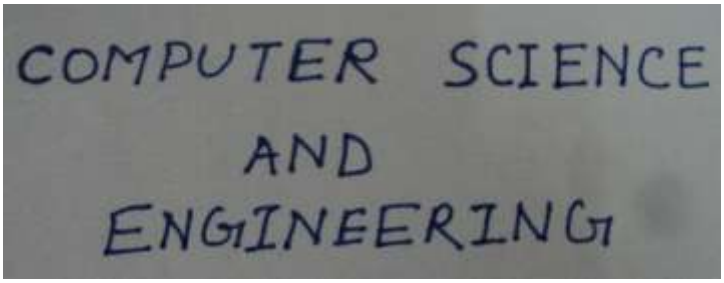


**Figure 1. Sample for Character Recognition.**

## II. METHODOLOGY

There are two techniques in detail and comparison between them:

### 2.1 Particle Swarm Optimization

Particle swarm optimization (PSO) is a population based stochastic optimization technique ,inspired by social behavior of bird flocking or fish schooling [5]. PSO learned from the scenario and used it to solve the optimization problems. In PSO, each single solution is a "bird" in the search space. It is called "particle". All of particles have fitness values which are evaluated by the fitness function to be optimized for better solution, and have velocities which direct the flying of the particles in problem area. The particles fly through the area that is problem space by following the current optimum particles [6].

### 2.2 Genetic Algorithm

The Genetic Algorithms (GAs) is inspired by the principles of genetic and mimics the reproduction behavior, and evolution observed in biological population. In a genetic algorithm, a population of candidate solution to an optimization problem is evolved toward better solutions. Genetic Algorithms generates solutions to optimization problems using technique inspired by natural evolution.

At each generation, each individual is evaluated and recombined with others on the basis of its fitness. The expected number of times an individual is selected for recombination is proportional to its fitness relative to the rest of the population. New individual are generated using crossover and mutation.

- Crossover operates by selecting a random location in the genetic string of the parents (crossover point) and concatenating the initial segment of one parent with the final segment of the second parent to create a new child. A second child is generated at the same time using the remaining segments of the two parents.
- Mutation provides for time to time disturbances in the crossover operation by inverting one or more genetic elements during reproduction [7][8][9].

### 2.3 Comparison between PSO and GA

PSO shares many similarities with evolutionary computation techniques such as Genetic Algorithms (GA) that means these two evolutionary heuristics are population-based search methods. They both depend on information sharing among their population members to enhance their search process using a combination of deterministic and probabilistic. The system is initialized with a population of random solutions and searches for optima by updating generations

Most of evolutionary techniques have the following procedure:

1. Random generation of an initial population in starting.
2. Reckoning of a fitness value for each subject which is uses. It will directly depend on the distance to the optimum.
3. Reproduction of the population based on fitness values.
4. If requirements are met in procedure, then stop. Otherwise go back to 2.

From the procedure, we can learn that PSO shares many common points with GA. Both algorithms start their procedure with a group of a randomly generated population. Both algorithms have fitness values to evaluate the population. Both techniques update the population and search for the optimum with random techniques. Both systems do not guarantee that their procedures will success.

However, PSO does not have genetic operators like crossover and mutation. PSO has only particles. Particles update themselves with the internal velocity. They have memory, which is important to the algorithm.

Compared with genetic algorithms (GAs), the information sharing mechanism in PSO is crucially different. In GAs, each chromosomes share information with other. So the whole population moves like a one group towards an optimal area search space. In PSO, only *gbest* (or *lbest*) brings out the information to others. It is a mechanism for sharing information in one way. The evolution only is used for the best solution. Compared with GA, all the particles arrive to converge to the best solution quickly even in the local version in most cases [5] [6] [11] [12].

## III. IMPLEMENTATION

PSO is initialized with a group of random particle (solution) and then searches for optima by updating generations. Each particle is updated by following two “best” values in every iteration. The first one is the best solution (fitness) it has achieved so far. The fitness value is also stored, this value called *pbest*. Another “best” value that is tracked by the particle swarm optimizer is the best value, obtained so far by any particle in the population. The best value is a global best and called *gbest*. When a particle takes part of the population as its topological neighbors, the best value is a local best and is called *lbest* [4]

After finding the two best values, the particle updates its velocity and positions with following equation (a) and (b).

$$v[] = v[] + c1 * \text{rand}() * (pbest[] - present[]) + c2 * \text{rand}() * (gbest[] - present[]) \quad \text{(a)}$$

*present*[] = *present*[] + *v*[] (b)

*v*[] is the particle velocity, *present*[] is the current particle(solution). *pbest*[] and *gbest*[] are defined as stated before. rand() is a random number between (0,1). c1, c2 are learning factors [6]. Usually c1=c2=2.

The pseudo code of the PSO procedure is as follows:

*For each particle*
Initialize particle
*End*

*Do*
*For each particle*
Calculate fitness value
If the fitness value is better than the best fitness
value (*pbest*) in history
Set current value as the new *pbest*
*End*

Choose the particle with the best fitness value of all the particles as the gbest

*For each particle*

Calculate particle velocity according equation (a)
Update particle position according equation (b)

*End*

*While* maximum number of iterations or minimum error criteria is not acquired.

Particle's velocities on each dimension are clamped to a maximum velocity $v_{max}$. If the sum of accelerations would causes the velocity on that dimension to exceed $v_{max}$, which is parameter defined by the user. Then the velocity on that dimension is limited to $v_{max}$ [6].

The pseudo code of the standard GAs procedure is as follows [9][10]:

*Begin* GA

*g*=0 generation counter
Initialize population
Evaluate population P(*g*) i.e., compute fitness values

*While* not done do

*g*=*g*+1

Select P(*g*) from P(*g*-1)

Crossover P(*g*)

Mutate P(g)

Evaluate P(g)

*End while*

*End* GA

## VI. RESULT

PSO has successfully applied for image enhancement application and demonstrated that PSO gets better results in a faster, cheaper way compared with GA evolutionary method. Also PSO is more attractive than GA is that there are few parameters to adjust compared with the large number of parameters adjusted when GA is run [3].

**Table 1. The fitness value of both PSO and GA using 200 generation [3].**

| Image/Fitness | PSO-based | GAs-based |
|---|---|---|
| Cameraman | 128.821 | 102.988 |
| Tire | 136.398 | 130.030 |
| Pout | 10.450 | 2.972 |
| House | 250.345 | 240.342 |

The above table shows the difference between PSO and GA when it applies in image enhancement. So the result is PSO may chance to give better result than GA in Character Identification.

## V. CONCLUSION

In this survey, Character Identification is having process that is necessary to follow for extracting and identifying character from the input handwritten text on piece of paper. In recognition problem is solved by these evolutionary techniques such as PSO and GAs. By using them, identifies unknown character in given image. Also improve the efficiency of the system when they are applied on the system.

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