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Fast Retrieval of Musical Data from Optimized Clusters using PSO

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Abstract: Information retrieval is concept related to various optimization techniques and clustering algorithms. High dimensional Textual dataset is required for information retrieval .swarm intelligence is one of the most important technique under evolutionary algorithms. Swarm intelligence technique includes various algorithms for optimization. Comparative study of those gives best algorithm on the basis of there computational time and efficiency. Best algorithm is identified for clustering .Comparative study of clustering algorithms gives best algorithm and used for information retrieval.

Keywords: High Dimensional Dataset Swarm Intelligence Technique, Clustering Optimization, Computational Time, Efficiency, Information retrieval.

I. INTRODUCTION

For the complex data sets there is a problem in retrieval the necessary information from particular records.

As the original datasets are multidimensional in nature, so for retrieving the particular information, datasets need to be multidimensionality reduced.

Hence, for these there are different optimization techniques or algorithms , and with the help of those algorithms the datasets are first reduced and then that datasets are provided as an input to the algorithms i.e Particle Swarm Optimization, Ant Colony Optimization and Then clusters are obtain for information retrieval system.

- Swam Intelligence(SI)
- Swarm Intelligence algorithms are –
- Particle Swarm Optimization(PSO)
- Ant Colony Optimization(ACO)
- Artificial Bee colony Optimization(ABCO)
- Bat Optimization(BO)

Using all these algorithms and with the help of comparison between these algorithms there is a retrieval of information from the particular data sets, and as well as development of IR system also takes place.

II. MODULES

Module:1(Comparison of Swarm Intelligence Technique algorithms):
Comparison of Swarm intelligence techniques algorithms based on reduction of dataset and computation time using optimization.
Algorithms:

- Particle Swarm Optimization
- Ant Colony optimization
- Artificial Bee Colony Optimization
- Bat optimization

Module:2 (Selection of Best Optimization Algorithm)
After comparing Swarm Intelligent Technique algorithms identified Particle Swarm Optimization algorithm.

Algorithm: Particle Swarm Optimization.

Module:3 (Apply clustering algorithms on Particle Swarm Optimization) :
In this module, we apply two clustering algorithm and compare those algorithm for identify best cluster algorithm of particle swarm optimization.

clustering algorithms are:
1. 1.k-means clustering algorithm
2. 2.Hierarchical clustering algorithm

Module:4 (formation of cluster of PSO)
In this module, After applying clustering algorithm on particle swarm optimization identified best cluster algorithm i.e Hierarchical clustering algorithm.

Clusters obtain for the Best algorithm are used for information retrieval from system.

There are many applications of IR so any kind of information may retrieve from the system.

Module: 5 (Information Retrieval)
In this module, Information retrieves from System.

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III. SYSTEM ARCHITECTURE

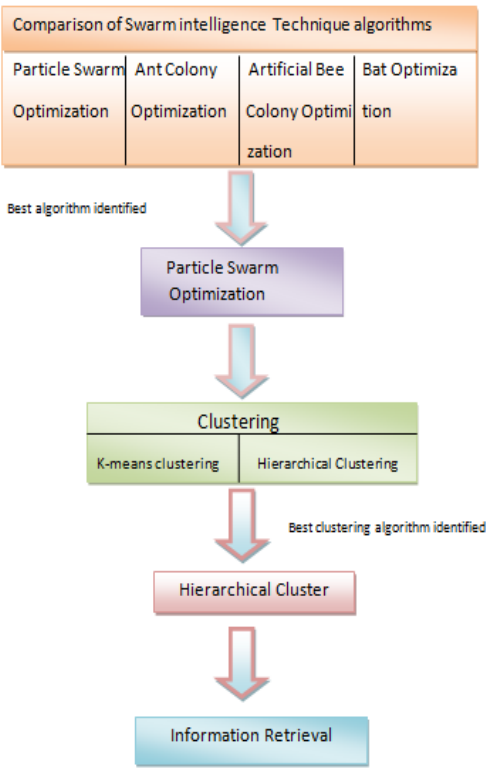

Fig.1: System Architecture

IV. ALGORITHMS

A. Particle Swarm Optimization(PSO):

Particle Swarm Optimization (PSO) is a global optimization algorithm for dealing with problems in which a best solution can be represented as a point or surface in an n-dimensional space. Hypotheses are plotted in this space and seeded with an initial velocity, as well as a communication channel between the particles.[4]

Algorithm: Pseudo code for PSO:	
1	Initialize all particles
2	Calculate fitness value of each particle
3	Find best fitness value out of that all particles
4	If the fitness value is better than the best fitness value (pBest),then Set pBest = current fitness value
5	If pBest is better than gBest, Set gBest = pBest
6	Calculate particle Velocity Use gBest and Velocity
7	Update particle Data[4]

B. Ant Colony Optimization(ACO):

Ant Colony Optimization (ACO), introduced by Dorigo in his doctoral dissertation, is a class of optimization algorithms modeled on the actions of an ant colony Artificial 'ants' simulation agents locate optimal solutions by moving through a parameter space representing all possible solutions. Natural ants lay down pheromones directing each other to resources while exploring their environment.[4]

Algorithm: Pseudo code for ACO	
Scheme:	
1	Construct ant solutions
2	Define attractiveness $\tau 0$, based on experience from solution
3	Define specific visibility function, η, for a give problem (e.g. distance)

Ant walk

1. Initialize ants and nodes (states)
2. 2.Choose next edge probabilistically according to attractiveness and visibility
3. Each ant maintains a taboo list of infeasible transitions for that iteration
4. Update attractiveness of an edge according to the number of ants that pass through
5. Pheromone update Parameter is called evaporation rate
6. Pheromones = long-term memory of an ant colony

ρ small → low evaporation → slow adaptation
ρ large → high evaporation → fast adaptation

"new pheromone" or $\Delta\tau$ usually contains the baseattractiveness constant Q and a factor that you wantto optimize [4]

C. Artificial Bee Colony Optimization

Artificial Bee Colony Algorithm (ABC) is a meta-heuristic algorithm introduced by Karaboga in 2005, and simulates the foraging behaviour of honey bees. The ABC algorithm has three phases: employed bee, onlooker bee and scout bee. [3]

Algorithm: Pseudo code for ABC	
1	Initialization phase
	REPEAT
2	Employed Bees phase
3	Onlooker Bees phase
4	Scout Bees phase
5	Memorize the best solution achieved so Far
6	UNTIL (cycle=Maximum Cycle Number or Maximum CPU time) [3]

D. Bat Optimization

Bat-inspired algorithm is another nature-inspired optimization algorithm developed by Xin-She Yang.

The algorithm is based on the echolocation behaviour of microbats with varying pulse rates of emission and loudness.

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ALGORITHM: Pseudo code for BO

We have to define the rules how the bat's positions x_i and velocities v_i in a d-dimensional search space are updated. The new solutions x^t_i and velocities v^t_i at time step t are given by

$f_i = f_{min} + (f_{max} - f_{min})\beta$

$v_i^t = v_i^{(t-1)} + (x_i^4 - x_*)f_i$

$X_i^t = x_i^{(t-1)} + v_i^t$

……..where $\beta \in (0,1)$

One solution selected from among many solutions.,

$X_{new} = X_{old} + \Sigma A^t$

…….where $\Sigma \in [-1,1]$

$A^t = <A_i^t>$…..(average loudness of all bats)

V. CLUSTERING ALGORITHMS

1. **k-means algorithm:** The algorithm is extended to use K-means clustering to seed the initial swarm. This algorithm uses PSO to refine the clusters formed by K-means. Results show that both PSO clustering techniques have much potential.
2. **Hierarchical algorithm:** This clustering algorithm shows step by step grouping. In Hierarchical algorithm use the two type of method i.e first is Agglomerative and second is divisive . Hierarchical clustering is a method of cluster analysis which seeks to build a hierarchy of clusters.

VI. EXPERIMENTAL RESULTS

A. Comparison of Swarm Intellingence technique algorithms:

1. Ant Colony Optimization

```
Begin Ant Colony Optimization
Number cities in problem = 259
Number ants = 4
Maximum time = 100
Alpha (pheromone influence) = 3
Beta (local node influence) = 2
Rho (pheromone evaporation coefficient) = 0.01
Q (pheromone deposit factor) = 2.00
Initialing dummy graph distances
Initialing ants to random trails0: [ 203 37 16 246 . . . 153 248 207 255 ] len = 1135.0
1: [ 193 7 216 209 . . . 49 38 258 168 ] len = 1123.0
2: [ 138 17 203 113 . . . 67 195 133 97 ] len = 1239.0
3: [ 92 119 66 81 . . . 29 1 38 130 ] len = 1112.0
4: [ 249 16 192 32 . . . 25 236 5 42 ] len = 1244.0

Best initial trail length: 1112.0
Initializing pheromones on trails
Entering UpdateAnts - UpdatePheromones loop
New best length of 1104.0 found at time 0
New best length of 1086.0 found at time 1
New best length of 1077.0 found at time 13
New best length of 1063.0 found at time 70
Time complete
```

Fig. 2.1: Result of ACO

2. Particle Swarm Optimization

```
Particle Swarm Optimization
Number swarm = 4Deposit factor = 2.000: [ 49 54 188 84 . . . 134 137 87 156 ] len = 1172.0
1: [ 35 30 174 144 . . . 213 225 170 212 ] len = 1169.0
2: [ 117 160 109 137 . . . 0 156 245 45 ] len = 1212.0
3: [ 202 51 118 48 . . . 74 137 244 97 ] len = 1176.0
Best initial trail length: 1169.0
New best found at time 0
New best found at time 1
New best found at time 21
New best found at time 33
New best found at time 36
New best found at time 63Best Result at:251 90 42 230 39 51 214 249 43 257 136 165 34
110 186 38 65 85 126 196 88
203 11 6 91 75 109 198 205 221 134 190 74 168 4 151 130 258 10 182 200
166 77 129 123 117 32 248 118 14 176 197 93 229 175 48 78 35 144 226 204
17 47 81 125 207 96 128 105 36 170 62 72 202 255 178 131 145 143 231 33
113 80 192 44 195 101 104 247 218 67 94 116 40 240 183 124 254 3 179 22
164 149 76 100 114 127 155 234 256 180 199 154 171 188 82 194 106 27 187 95
244 137 147 225 63 211 23 220 60 50 122 138 222 209 120 228 0 79 184 59
213 132 246 25 133 191 206 102 150 242 8 219 61 64 26 24 253 103 18 160
83 181 156 208 45 53 189 233 52 111 185 15 97 107 152 108 141 92 71 142
2 172 55 69 31 167 49 148 169 86 236 153 54 13 241 12 237 37 243 66
1 232 56 21 46 245 119 223 177 173 157 146 19 158 162 193 115 68 161 139
5 41 58 227 163 30 224 84 135 140 159 87 112 9 174 20 121 28 29 73
```

Fig. 2.2: Result of PSO

3. Artificial Bee Colony Optimization

```
Artificial Bee Colony
Number bee = 4Deposit factor = 2.000: [ 238 62 66 95 . . . 94 7 201 82 ] len = 1149.0
1: [ 29 6 186 214 . . . 185 168 117 252 ] len = 1162.0
2: [ 24 182 32 78 . . . 89 59 97 232 ] len = 1172.0
3: [ 200 57 232 42 . . . 208 55 94 17 ] len = 1092.0
Best initial trail length: 1092.0
New best found at time 5
New best found at time 32
New best found at time 71
New best found at time 77Best Result at:82 133 34 103 209 1 140 243 132 191 72 32 244
219 221 247 83 178 31 194 204
213 166 75 29 165 160 251 118 119 186 155 218 7 158 70 200 180 59 43 127
104 220 253 241 125 91 76 203 60 175 30 212 22 121 123 223 214 65 38 94
144 115 9 2 170 68 236 53 145 44 156 112 248 61 97 255 174 89 154 71
84 40 52 199 152 202 192 137 28 108 242 109 19 206 240 245 205 250 64 54
114 18 56 16 17 172 226 217 24 130 45 124 167 225 10 101 66 73 106 229
138 95 15 36 57 47 98 41 86 120 48 187 20 110 215 69 239 35 182 235
234 231 122 163 77 131 196 58 189 146 179 147 148 100 181 14 0 23 224 233
88 183 143 171 90 126 105 74 6 208 129 26 153 136 254 168 246 116 228 193
96 33 107 197 188 162 39 177 176 195 51 222 67 207 150 49 85 198 78 211
11 134 42 252 12 149 257 8 111 13 46 151 63 25 141 55 92 216 249 184
81 173 159 87 157 164 230 210 237 185 62 27 21 4 169 238 258 113 142 37
139 5 93 161 135 190 128 50 80 102 256 117 227 99 201 79 232 3
```

Fig. 2.3: Result of ABCO

4. Bat Optimization

```
Bat Optimization
Number bat = 4Deposit factor = 2.000: [ 19 152 212 28 . . . 128 50 160 96 ] len = 1106.0
1: [ 47 50 237 212 . . . 49 83 30 78 ] len = 1156.0
2: [ 30 164 82 69 . . . 106 1 224 26 ] len = 1179.0
3: [ 249 55 67 11 . . . 196 63 91 105 ] len = 1175.0
Best initial trail length: 1106.0
New best found at time 7
New best found at time 23Best Result at:140 7 83 153 45 152 167 217 253 59 215 163 228
2 96 74 181 97 147 99 193
223 39 188 137 116 105 32 122 113 19 134 52 190 121 212 226 71 243 170 214
87 17 148 81 177 129 146 251 77 157 85 58 166 249 179 227 151 10 187 41
126 89 136 35 75 108 37 141 145 107 104 112 241 143 95 206 158 94 229 247
220 36 33 218 192 64 150 199 204 245 61 54 48 120 76 257 135 102 3 57
82 6 103 233 42 236 73 18 156 234 67 44 40 201 84 88 47 185 115 9
222 109 198 169 30 34 55 124 56 114 63 31 110 173 171 216 203 68 180 219
252 132 38 237 178 14 13 125 27 256 208 224 258 250 101 242 66 202 189 1
175 225 213 28 164 22 205 144 29 131 155 240 8 160 16 92 53 230 246 20
24 196 79 65 162 111 49 117 60 176 149 248 139 172 26 15 174 4 72 142
78 133 86 184 118 231 209 106 238 5 195 119 211 182 235 232 154 161 130 51
244 93 90 127 254 165 80 91 100 255 191 25 168 70 200 159 123 183 207 194
98 197 50 12 221 11 21 210 138 43 69 0 62 23 186 239 46 128
```

Fig. 2.4: Result of BO

B. Clustering Result: Clustering result described on the basis of following parameter which shown in table:

1.Length
2.Quality
3.Size

Parameters	SERVERS							
	1	2	3	4	5	6	7	8
Length	70	50	20	110	150	200	40	10
Quality	100	170	50	20	150	80	200	200
Size	5	10	5.7	1.5	9.8	10	4.7	6.2

Table:1

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Here, 1,2,3,4,5,6,7 and 8 denote servers.

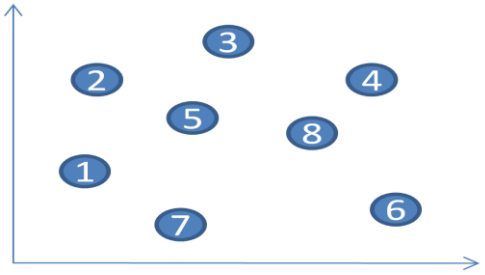

Fig. 3.1

1. Length:Calculate=Threashold value<100 Result=Server no 1,2,3,7 and 8 get the minimum distance

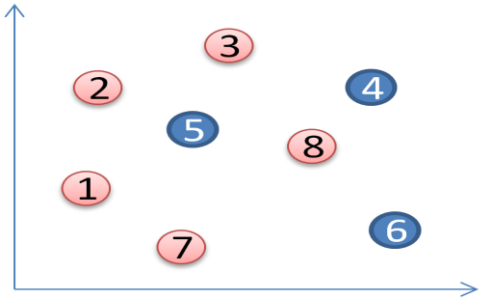

Fig. 3.2

2. Quality

- Calculate=Max(Quality)
- Result=Servers 7 and 8 has maximum quality

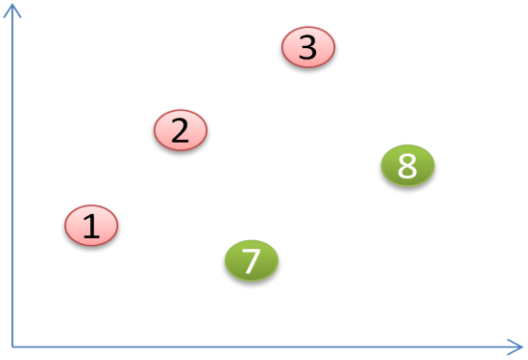

Fig. 3.3

3. Size

- Calculate=Min(Size)
- Result=Server 7 which has min size

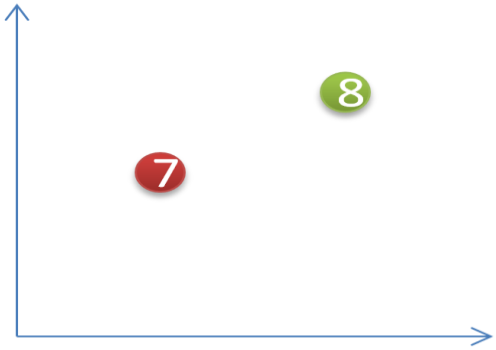

Fig. 3.4

C. Information Retrieval Result:

After result of clustering, we are move toward the result of information retrieval. Here information is retrieve using android application i.e MusicApp.

In MusicApp, information can be retrieve i.e selection of songs on the basis of following conditions:

1. Internal storage: In Internal storage, songs can be fetch out of its internal list.
2. Server searching: In Server searching, songs can be fetch out of one or more servers that is situated different location.
3. User Preferance: In this User preferance, songs can be fetch on basis of its user preferance. this can be happened on the basis of songs rating.

Following Fig shows the flow of MusicApp which retrieve information in terms of songs selection.

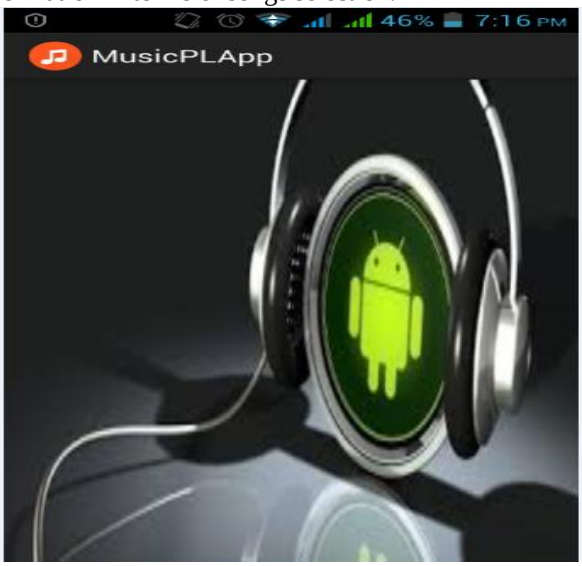

Fig. 4.1:MusicAPP interface

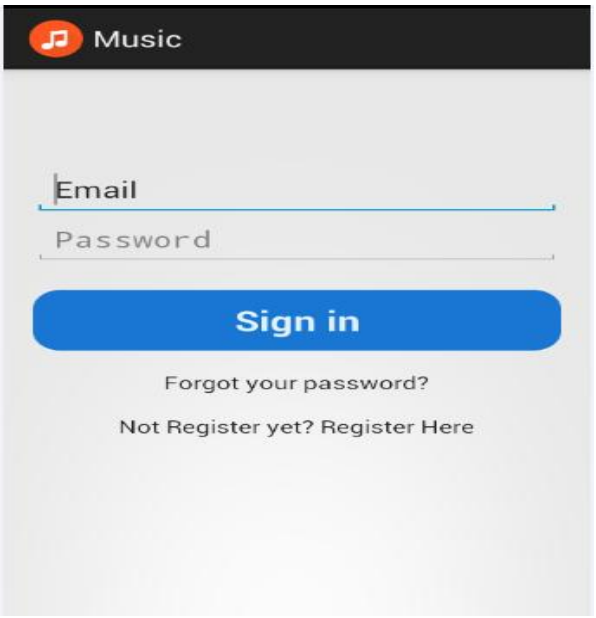

Fig. 4.2: login page

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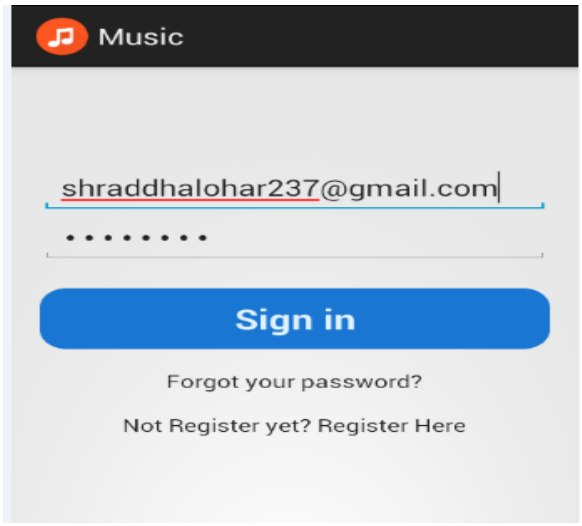

Fig. 4.3:login page

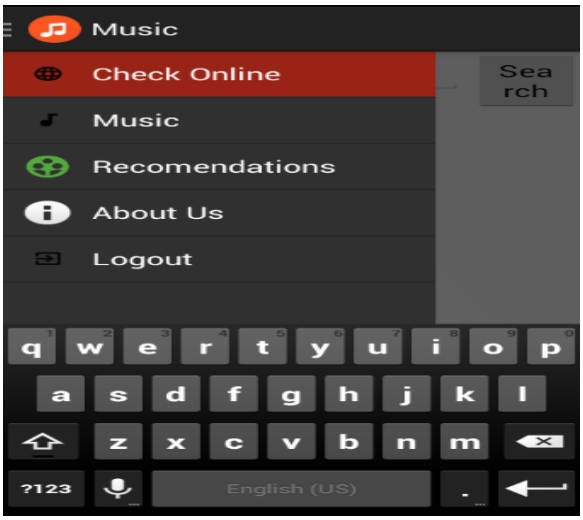

Fig. 4.4: check online

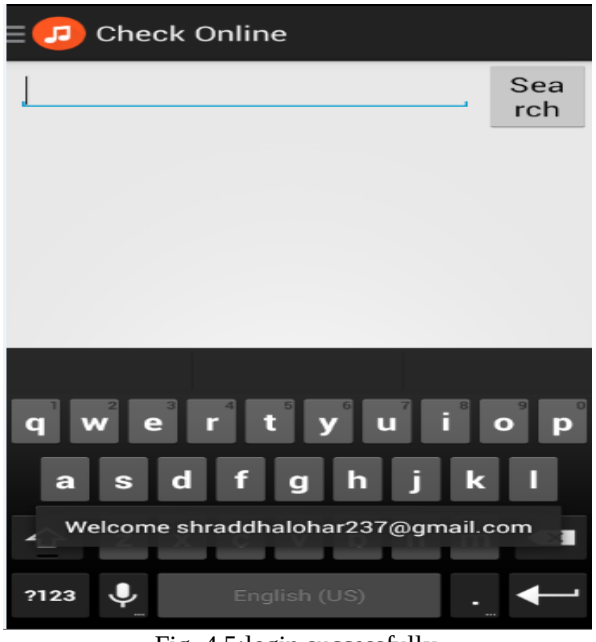

Fig. 4.5:login successfully

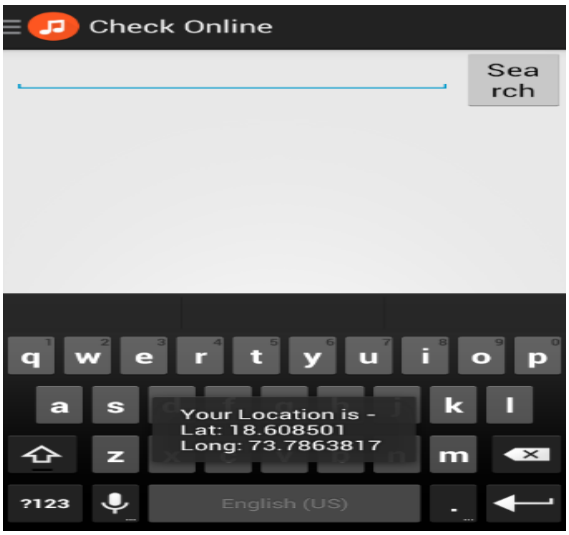

Fig. 4.6: Catch location of servers

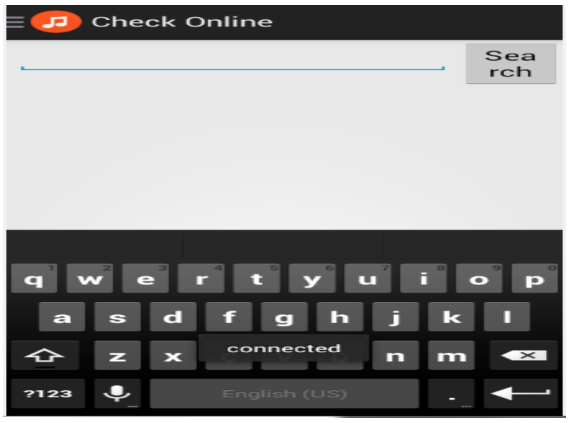

Fig. 4.7: Connected

Fig. 4.8: Database of songs

VII. CONCLUSION

This paper gives us to retrieve data with the help of optimization using evolutionary algorithm techniques. i.e. Swarm Intelligence Technique. Algorithms applied on input datasets to obtain output in the form of clusters. Comparison between output of these four algorithms (PSO,ACO,ABC,BO) gives best and efficient algorithm

for optimization of Information Retrieval as per user query. This paper includes implementation of PSO,ACO,ABC,BO algorithms and applying clustering on best algorithm i.e PSO to find best clusters. The future scope for this research would be optimization of information retrieval system like MusicApp.

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