Dimension Reduction Using Genetic Algorithm

ASIP PROJECT PRESENTATION

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Content

- Input from User
- Methodology
- Structure of the candidates.
- Initialisation, Mutation, Crossover, Fitness and Selection of Candidates
- Demonstration
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Input from User

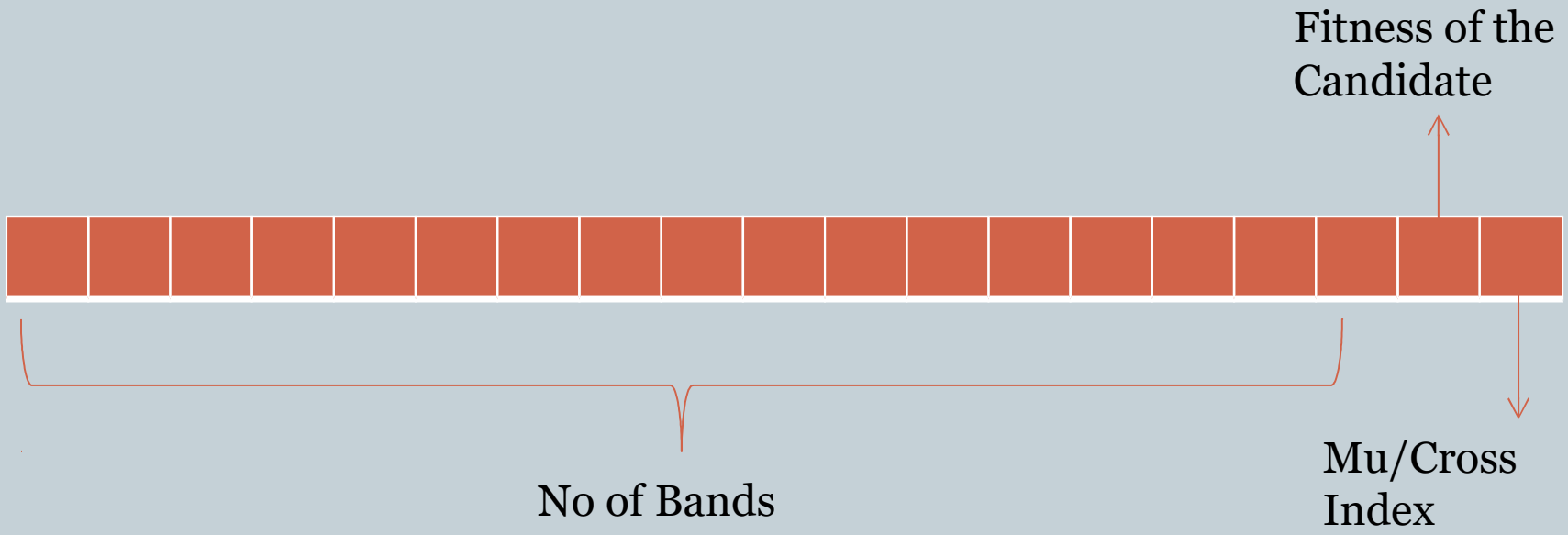
- Input image
- No of Bands to be selected
- No of Candidates in a Pool.
- No of Generations.
- Probability of Mutation of a candidate.
- Probability of Crossover of a candidate.
- Type of Fitness Function.
- Amount of Randomness in Selection of candidates.
- Saving the selected bands image.

Methodology

- Inputs from User.
- Initializing the Pool.
- Generating new population using Crossover, Mutation, assessing their fitness and Selection of candidates.
- Looping the above step with the mentioned no of generations.
- After the end of all generations, Best fit candidate is selected.

Structure of a Candidate

- A 1D array of No of Bands + 2 extra cells.

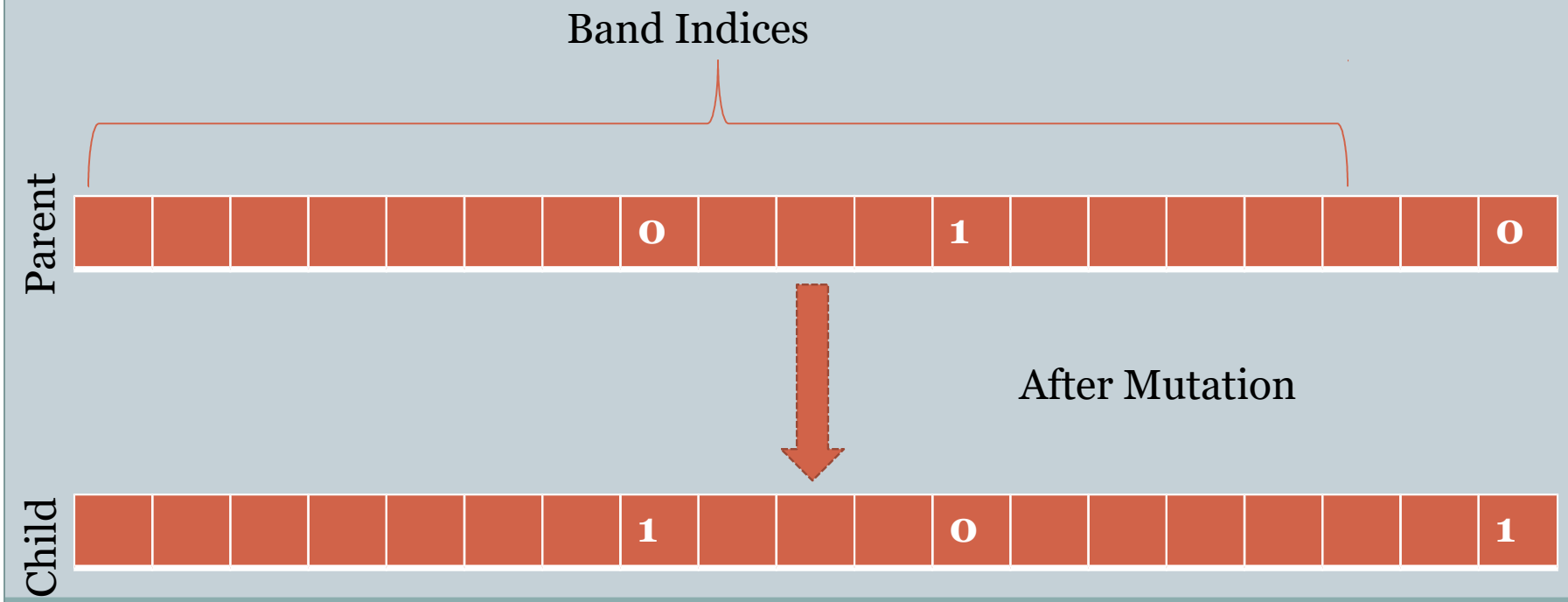


Initialization of Candidates

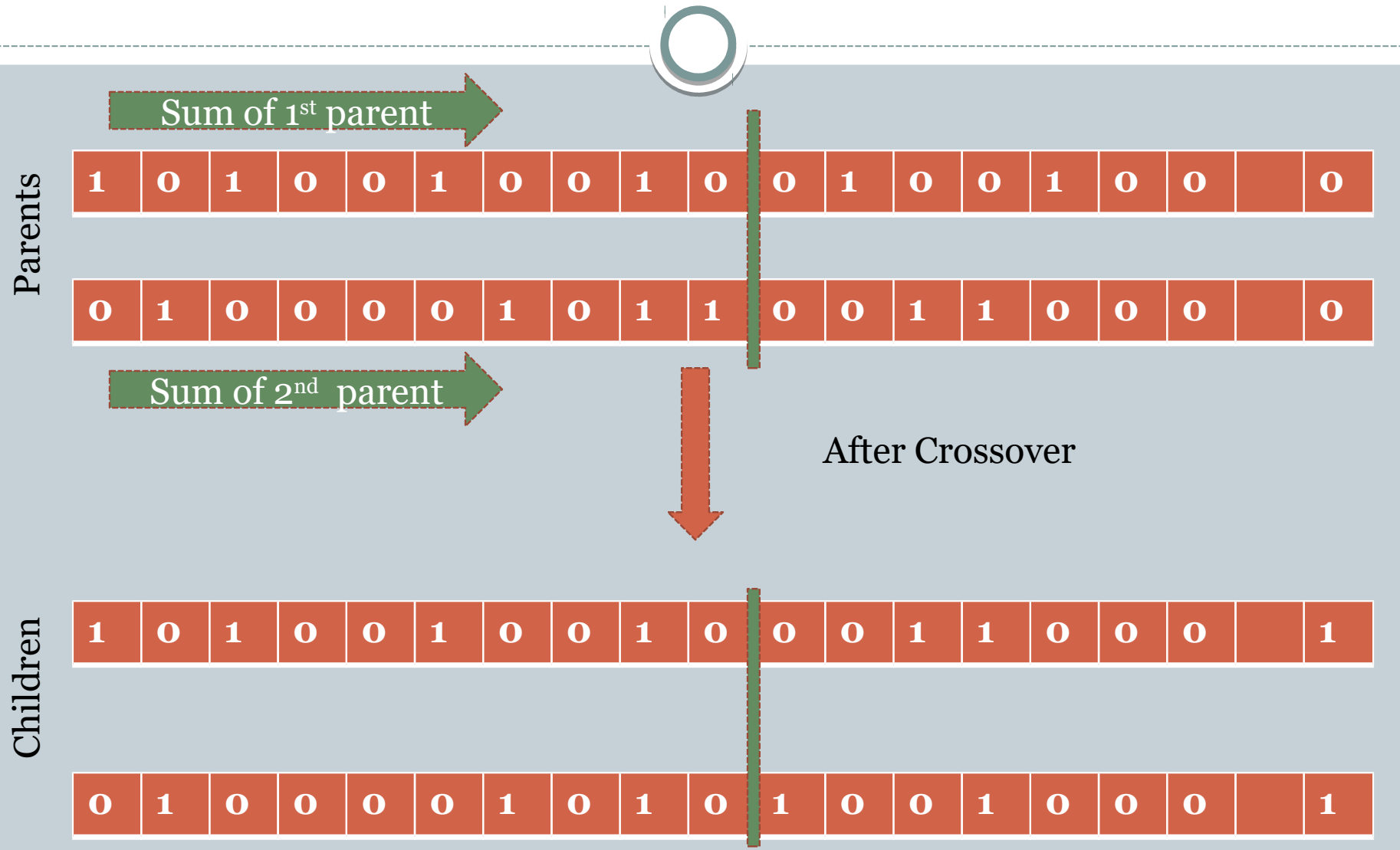
- Randomly assign the ones in the candidate (till the second last cell)
- The no of ones are equal to the no of bands to be selected.
- Assigning the fitness of the candidate in the initialization.

Mutation of Candidates

- In the Band indices, change a random 0 into 1 and vice versa.
- Calculated the fitness of the child candidate.



Crossover of Candidates



Fitness of the Candidate

- Make a temporary array of selected bands of a candidate.

Determinant Method

- In this method the determinant of covariance matrix is calculated.

Ratio Method

- Inspired by Pearson Coefficient of Correlation.

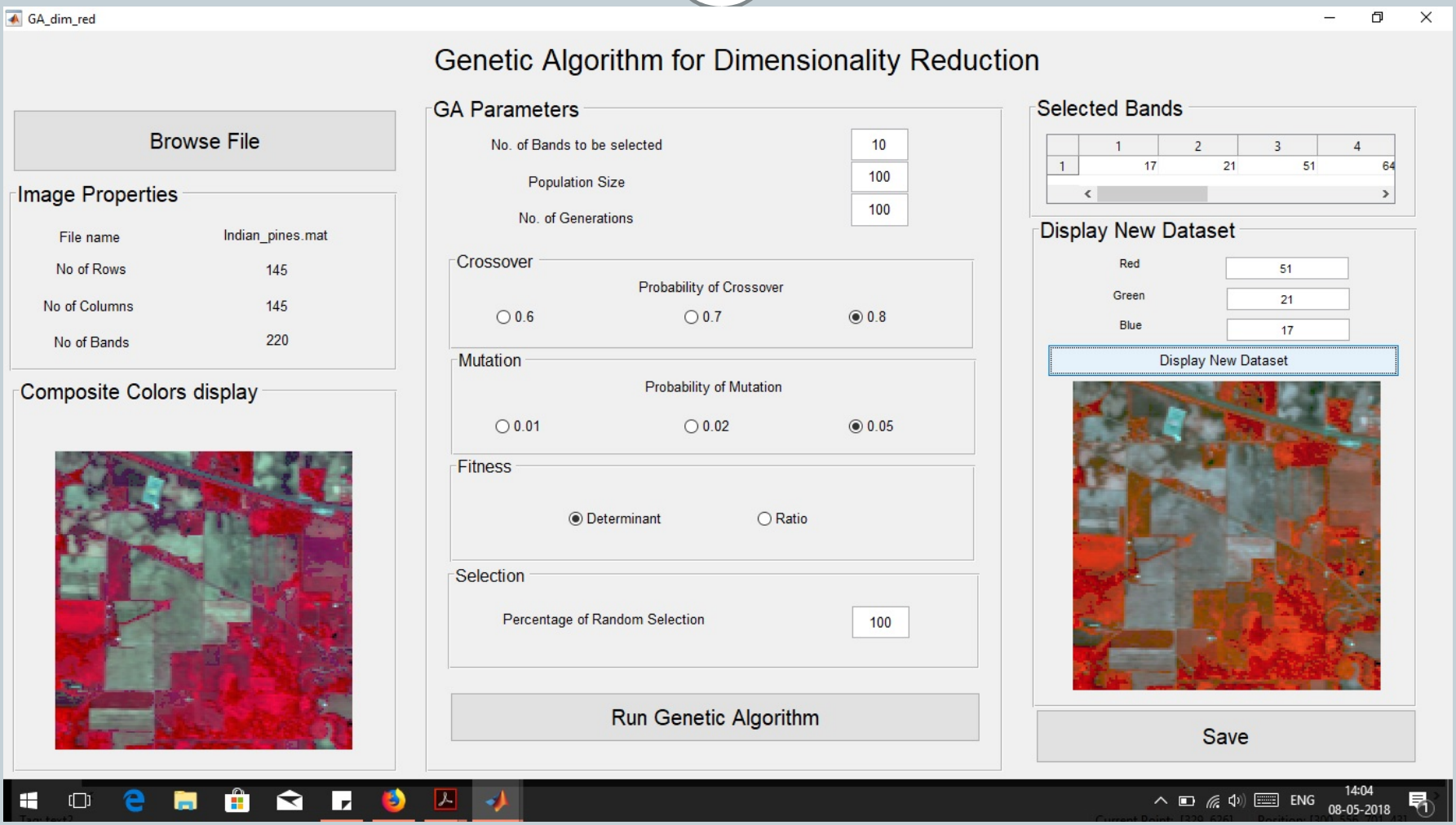
$$r = \frac{\sigma_1 * \sigma_2 * \sigma_3 \ldots . \sigma_{bands}}{C_{12} * C_{23} * C_{34} \ldots C_{(bands-1)bands}}$$

- Assigned as fitness value by taking log of the value.

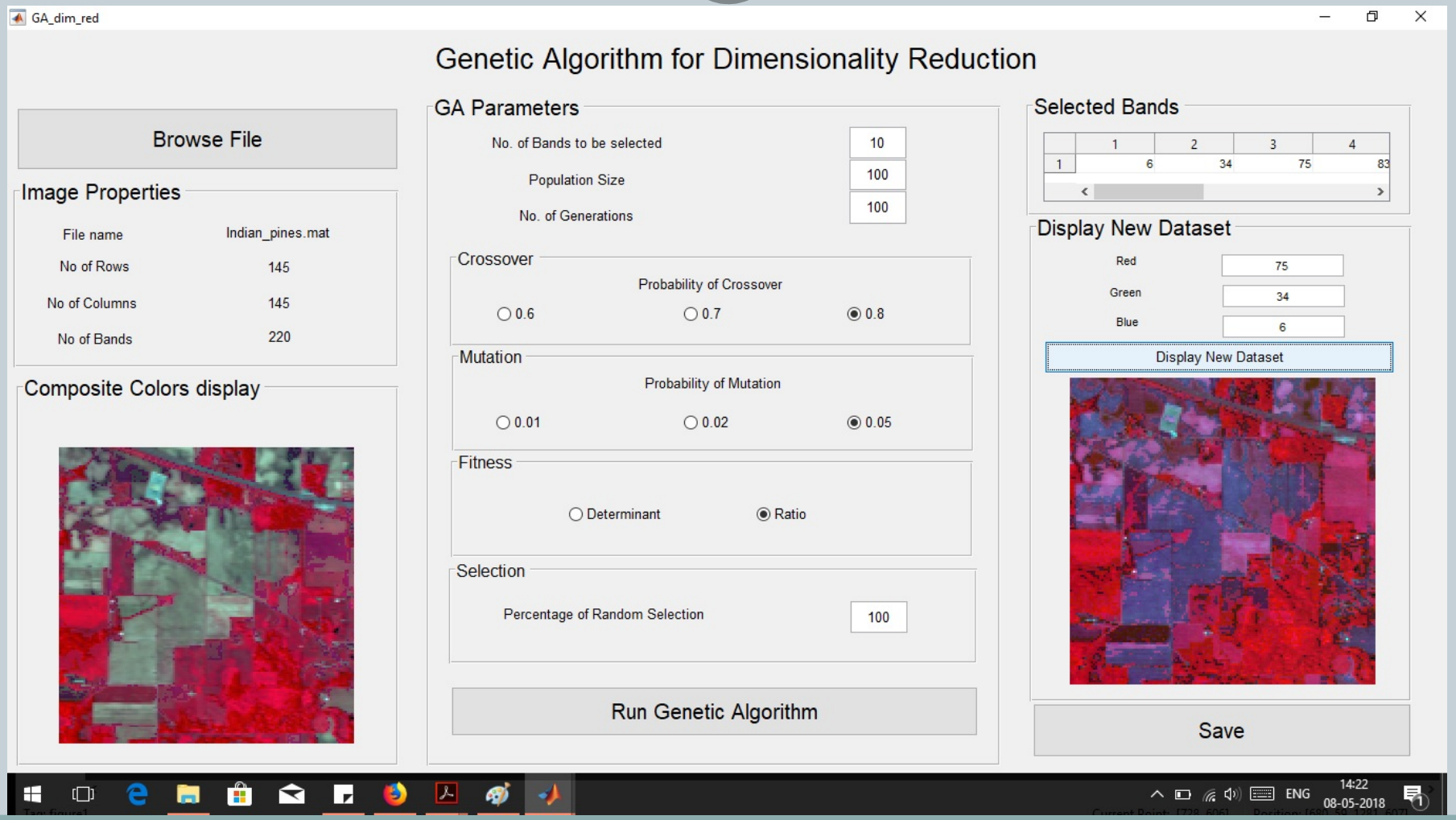
Selection of the Candidates

- The randomness in the selection is defined be the user.
- Say if User inputs 80% randomness, the top 20% of the required candidate will be directly selected and rest will be randomly selected.

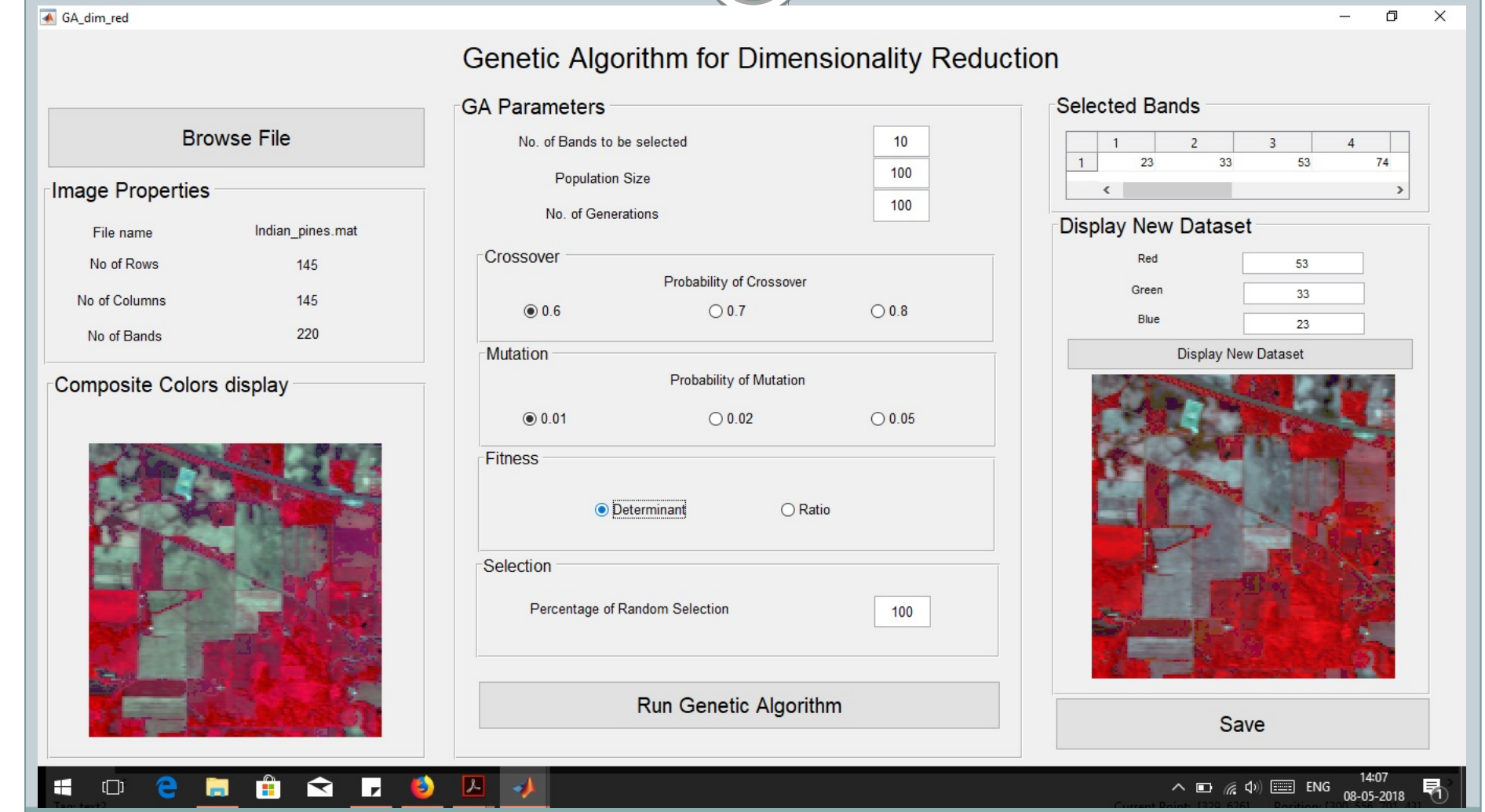
Snapshots of the GUI



Snapshots of the GUI



Snapshots of the GUI



Some Comparison

- Dataset Indian Pines
- No of selected Bands 10
- Pool size 1000
- No of generations 1000
- Mutation Probability 2%
- Crossover Probability 80%

With ratio as Fitness function

- Time Elapse 1141 s ~ 19min
- Bands Selected

15 17 40 100 101 156 158 187 215 218

With Determinant as Fitness function

- Time Elapse 1127 s ~ 19min
- Bands Selected

11 18 24 30 36 63 81 139 173 188

Future Scope

- Assessment of feature selection can be done with Supervised Classification Accuracy.
- Quantitative assessment of different scenarios with varying randomness, fitness function, etc.

Thank You