

# Genetic Algorithm in Optimization

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ARTIFICIAL  
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# Problem Description

# Problem Definition

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- Rainfall forecasting system based on genetic algorithm (GA).
- Aim of the project → Feature selection using Genetic algorithm in a binary classification model of rainfall prediction.
- Pre-optimization will be used, then the data will be fed to the prediction model.
- The model can be used anywhere such as, tourism planning, crop management, harvest seasons etc.

# Motivation

— — —

- Advantage of the randomness in data; unlike other predictive algorithms
- new method that may not be discovered through typical statistical or regression methods.
- Not a simple random walk; exploit historical information to speculate on a new search point
- Expected improvements to be seen

The background is a dark gray or black. It features several white and light gray abstract elements: a network of nodes and lines at the top, some binary code (0s and 1s) scattered throughout, and a series of small circles and squares at the bottom. A large, solid olive-green horizontal band spans the middle of the image, containing the title text.

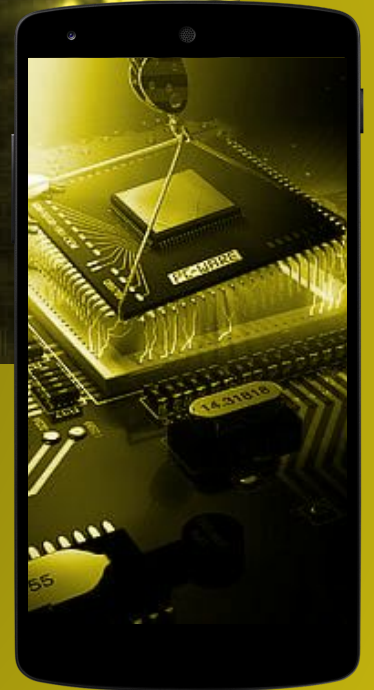
# Genetic Algorithm Introduction



# Survival of Fittest

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Genetic algorithms are randomized search algorithms that generate high-quality optimization solutions by imitating the biologically inspired natural selection process such as selection, cross-over, and mutation.



# Terminology and Operators :-

## **Population:**

Set of possible solutions for the stochastic search process to begin.

## **Chromosome(Genotype):**

represents one candidate solution present in the generation or population.

## **Phenotype:**

decoded parameter list for the genotype that is processed by the Genetic Algorithm

## **Fitness Function:**

evaluates the individual solution or phenotypes for every generation to identify the fittest members.

## **Selection:**

process of selecting the fittest solution from a population, and then the fittest solutions act as parents of the next generation of solutions.

## **Cross-over:**

genes from the two fittest parents are randomly exchanged to form a new genotype or solution.

— — —



# Applications of Genetic Algorithm

1

## Search and Optimization

A Genetic Algorithm is used for Search and Optimization using an iterative process to arrive at the best solution out of multiple solutions

2

## Hyperparameter finding

A Genetic Algorithm can find an appropriate set of hyperparameters and their values for a deep learning model to increase its performance in Deep Learning

3

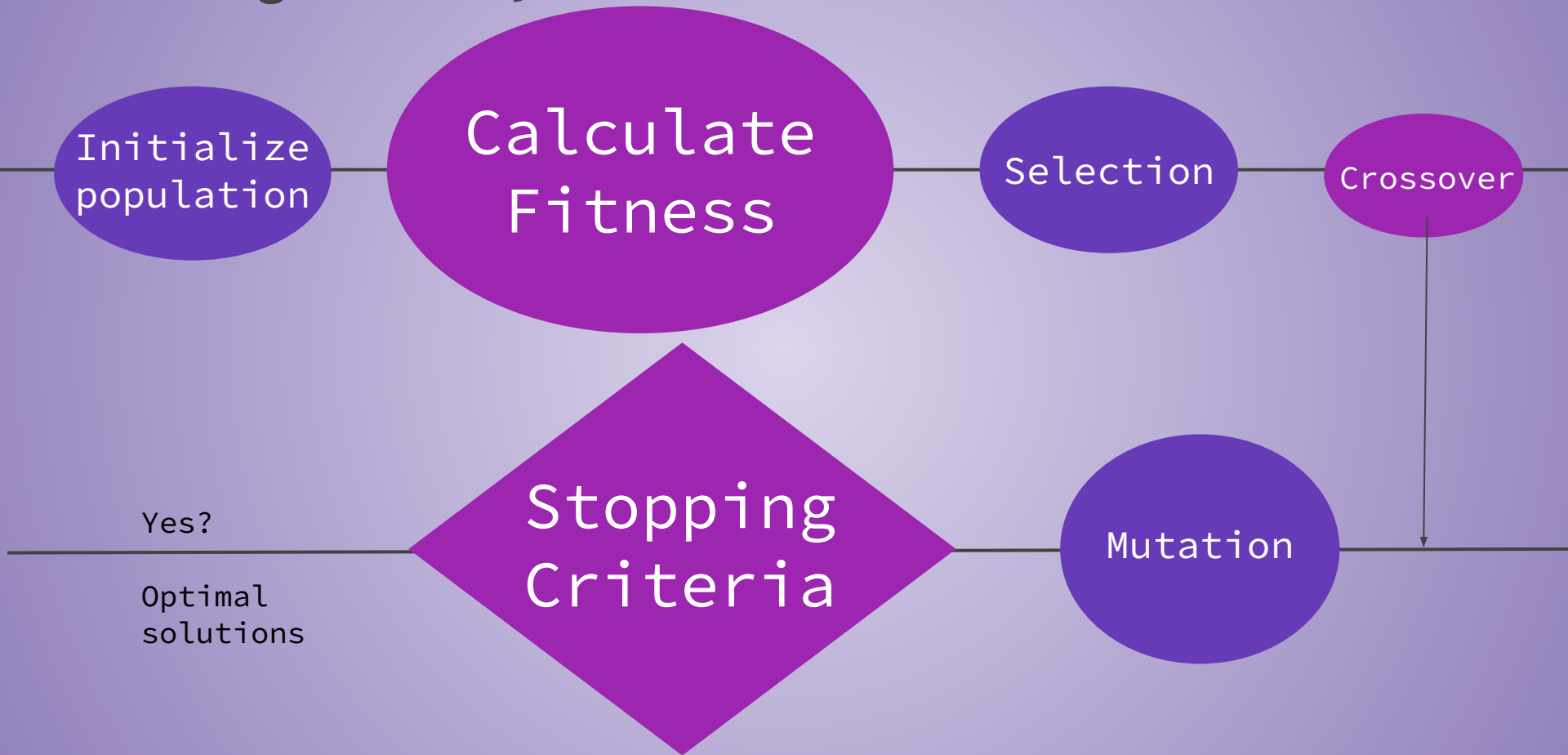
## Feature Selection

A Genetic Algorithm can also be used to determine the best amount of features to include in a machine learning model for predicting the target variable



# Genetic Algorithm Working

# Genetic Algorithm Layout:





# Code

# About Dataset

— — —

Predict next-day rain by training classification models on the target variable RainTomorrow.

This dataset contains about 10 years of daily weather observations from various weather stations across Australia.

RainTomorrow is the target variable to predict. It means -- did it rain the next day, Yes or No? This column is Yes if the rain for that day was 1mm or more.

Copyright Commonwealth of Australia 2010, Bureau of Meteorology.

Source: Kaggle; <http://www.bom.gov.au/climate/dwo/>, <http://www.bom.gov.au/climate/data>.

# Notebook

— — —

<https://colab.research.google.com/drive/13qmGH8imEiTMzN3IWmQKO-WYfS5c0eV?usp=sharing>



# Expected Outcome

*Towards the aim —>*

# Expectation

— — —

- We use optimization for increasing the performance of the classifier and thereby making a rainfall prediction system.
- This set is such that it is the most optimized combination and extremely random



# Result and Conclusion



# Output

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- ★ 1-2 % increase in the improvement can be seen with the generations when Knn and RadialSVM classifier is used for the prediction of rainfall.
- ★ The given dataset goes under overfitting with following classifiers: LinearSVM, Logistic, Random Forest, AdaBoost and Decision tree.

```
▶ # import KNeighbors Classifier from sklearn  
from sklearn.neighbors import KNeighborsClassifier
```

```
# instantiate the model  
knn = KNeighborsClassifier(n_neighbors=4)
```

```
# fit the model to the training set  
logmodel= knn.fit(X_train, Y_train)  
logmodel
```

```
↗  
▼ KNeighborsClassifier  
KNeighborsClassifier(n_neighbors=4)
```

```
[ ] X_train,X_test, Y_train, Y_test = split(data,label)  
chromo_df_bc,score_bc=generations(data,label,size=80,n_feat=data.shape[1],n_parents=64,mutation_rate=0.20,n_gen=5,  
                                   X_train = X_train,X_test = X_test,Y_train = Y_train,Y_test = Y_test)
```

```
Best score in generation 1 : [0.8384]  
Best score in generation 2 : [0.84208]  
Best score in generation 3 : [0.84928]  
Best score in generation 4 : [0.842]  
Best score in generation 5 : [0.84008]
```

***Improvement of 1-2% can be seen as the generation increases.***

# Presentation By:

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Thank you!

