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Part - B

Q.2] a] Bacterial Foraging Algorithm:

- This algorithm is inspired by a bacteria named E. coli. It normally lives in the intestines & helps in digesting the food. This optimization ~~is~~ is named as Bacterial Foraging Optimization.
- A bacteria usually as 2 operations i.e. a] Swim and b] Tumble

→ Algorithm:

1. CHEMOTAXIS: a] When a bacteria meets a ~~favourable~~ favourable environment, it will continously swim in same direction
~~tumble~~ → tumble → run → run
b] ~~when~~ when it meets unfavourable environment it will tumble and change direction of swim.
tumble → run → tumble

2. Swarming: E. coli has a specific seeming actuation of decision making mechanism. On each move it releases signals that attract other bacteria towards it.

3. Reproduction: After calculating fitness value of each bacteria reproduction allows bacteria to survive & reproduce.

4. Elimination & dispersal: Unfit bacteria are eliminated.

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6]. The reason why SVM or Support Vector Machine is popular for classification of 2D data is its ability to seperate the data points by a boundary called as the Hyperplane.

- SVM tries to make a decision boundary in such a way that the separation between the two classes is maximum.
- We know, that the goal in SVM is to optimize k such that,

$$\frac{\partial J}{\partial w} = 0 \quad \text{and} \quad \frac{\partial J}{\partial b} = 0.$$

Hence, $w_o = \sum_{i=1}^{N} \alpha_i d_i x_i$ and $\sum_{i=1}^{N} \alpha_i d_i = 0$

- maximize k such that, $-w^T x + b \geq k$, for $d_i = 1$
  $-w^T x + b \leq k$, for $d_i = -1$
- We finally obtain

$$J(w,b,\alpha) = \frac{1}{2} w^T \cdot w - \sum_{i=1}^{N} \alpha_i d_i (w^T x_i + b) + \sum_{i=1}^{N} \alpha_i$$

which proves that the decision boundary would be as wide as possible.