- **Hybrid computational intelligence algorithms and their applications to detect food quality**

  Link: https://link.springer.com/article/10.1007/s10462-019-09705-8?fbclid=IwAR1ypV6zQn-K3iPAnQ3vQgfncPUfbL6sPumeMjox2F78koalwJmvWqeRuMk#citeas

Summary

Food quality inspection is essential for the safety of our health and identifying spoiled foods can go a long way to enhance food storage life. This paper develops an algorithm combining other three algorithms, for instance, Moth Flame Optimization (MFA), Particle Swarm Optimization (PSO) and Gravitational Search Algorithm (GSA). The combination of the MFA-GSA-PSO hybrid algorithm contains 83.33% accuracy rate which is way more than implementing only one algorithm for rotten food detection.

Methodology

The authors used algorithms 'MFA-GSA-PSO' altogether with K-means clustering for better detection of defective parts or disease (moths/ fungi can develop disease on food skin) on food skin. At the time of image processing, k means clustering can easily detect the spoiled parts and this algorithm generally breaks down images into smaller parts. Therefore, rotten food detection has a higher accuracy rate.

Equations

- Each moth travels around a flame in a logarithmic spiral, S:

$$S(M_i, F_i) = D_i e^{bt} \cos(2\pi t) + F_i$$

- Newton's gravitational law the force is calculated by dividing the masses by R2 instead of R,

$$F_{ij} = G \times (M_{aj} \times M_{pi})/R$$

$$a_i = \sum_{j=1 \ and \ j \neq i}^{n} F_{ij}/M_{ii}$$

- The velocity of the search agent at time t is given by,

$$v(t) = v(t-1) + c_1 r_1 (p(t-1) - x(t-1)) + c_2 r_2 (g(t-1) - x(t-1))$$

Algorithm Used

The researchers used here as follows:
- Moth Flame Optimization (MFA)
- Particle Swarm Optimization (PSO)
- Gravitational Search Algorithm (GSA)
- K-means clustering

Findings

The accuracy rate of identifying rotten foods can rapidly increase if the 'MFA-GSA-PSO' hybrid algorithm is used with K-means clustering for clearly identifying rotten areas on fruit peel or upper surface of food.

Novelty

Authors of this paper used the hybrid form of 'MFA-GSA-PSO' algorithm for better rotten image detection, they also provide a previous list of various algorithmic differences in terms of food quality inspection.

Analysis

In the analysis phase, they depicted the convergence curves for benchmark functions while clearly identifying every single clustering stage of ripe mango.

Research Gap

They didn't give a brief idea about IoT based hybrid algorithmic usage for calculating the shelf life of food.

Future Work

In future, using 'MFA-GSA-PSO' altogether with K-means clustering can be implemented with IoT devices.

Problems Faced

It is not clearly written here which type of components are used in times of conducting this research.