$$
X = \begin{array}{c} f_1, f_2, f_3, f_4 \\ \begin{bmatrix} & & & \cdot \\ \cdot & \cdot & \cdot & \\ \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \\ & & \cdot & \cdot \\ & \cdot & & \end{bmatrix} \end{array}
\qquad
\begin{array}{c} \underline{y} \quad (0,1,2) \\ y_1 \\ \vdots \\ y_n \end{array}
$$

$\underline{\text{I}}$

$y_1, y_2, \ldots\ldots y_n$

$0 \quad 2, 1, 0 \ldots 1, 2, \ldots 0$

→ Calculate Entropy of this group

$E_{initial}$.

$\widehat{II}$

$$X = \begin{array}{c} f_1, f_2, f_3, f_4 \\ \begin{bmatrix} \cdot & \cdot & \cdot & \cdot \\ & \cdot & \cdot & \cdot \\ & \vdots & & \vdots \\ & \cdot & \cdot & \cdot \end{bmatrix} \end{array} \quad \begin{array}{c} y \\ y_1 \\ y_2 \\ \vdots \\ y_n \end{array}$$

assume a weight $\bar{w} = [w_1, w_2, w_3, w_4]$

$$\hat{y} = \bar{X} \cdot \bar{w} = \hat{y}_1, \hat{y}_2, \hat{y}_3 \cdots \hat{y}_n$$

Sort them from min to max

$$\hat{y}_{sort} = \hat{y}_i, \hat{y}_{i+1}, \cdots \hat{y}_j$$

assume a threshold t.

$$\hat{y}_{sort} = \underbrace{\hat{y}_i, \hat{y}_{i+1}, \cdot}_{G_1} \Big|_{t} \underbrace{\cdots \hat{y}_j}_{G_2}$$

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$$\hat{y}_{sort} = \underbrace{\hat{y}_i, \hat{y}_{i+1}, \ldots}_{G_1} \;\Big|_{t}\; \underbrace{\ldots \hat{y}_j}_{G_2}$$

Calculate entropy for G_1 and G_2

E_{G_1}, E_{G_2}

$$\text{Total entropy } (E_{Total}) = \frac{|E_{G_1}| * E_{G_1} + |E_{G_2}| * E_{G_2}}{|E_{G_1}| + |E_{G_2}|}$$

Info Gain ($\underline{IG}$) $= E_{Total} - E_{initial}$

IV The PSO problem

particle$_1$ $(\bar{w}_1, t_1)$

particle$_2$ $(\bar{w}_2, t_2)$

⋮

particle$_n$ $(\bar{w}_n, t_n)$

Each particle is defined by a set of weights $\bar{w}$ & threshold t.

$\boxed{\underline{\text{Objective function}}}$:

```
def obj-fun(w, t, x, y):
    ...
    return entropy
```

(v) The update function:-

def update( ):

for x number of iterations:

entropies = entropy for 20 particles

update each particle (P_{best})

update g_{best}

return g_{best}.