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Novel Mathematical Design of Furcifer Inspired and Nasuella Olivacea Optimization Algorithms for Active Power Loss Diminution in Electrical Transmission Network

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Abstract: This paper proposes Furcifer - inspired optimization (FIO) algorithm and Nasuella olivacea optimization (NOO) algorithm for solving the problem. Furcifer - inspired optimization (FIO) algorithm designed by emulating the common stalking activities of Furcifer. Furcifer own the competence to recognize the position of quarry by means of the swirl aspect of the eyeballs, and this characteristic creates to identify the prey in round directions. Furcifer pursuits the quarry, when it is disproportionately adjacent and the Furcifer are handy to the quarry and considered as premium Furcifer. Nasuella olivacea optimization (NOO) algorithm designed by imitating the Nasuella olivacea stalking action towards the Ctenosaura bakeri and Validity of Furcifer - inspired optimization (FIO) algorithm and Nasuella olivacea optimization (NOO) algorithm confirmed by verifying in 23 benchmark functions and IEEE systems.

Keywords: Real, Furcifer, Nasuella olivacea

Introduction

Numerous studies pondered the power problem [1-5] as the goalmouths errands deliberate conspicuously [8-11]. Active power loss reduction, power discrepancy protective and power consistency augmentation [13-20] are basic goalmouths of this paper. This paper proposes Furcifer - inspired optimization (FIO) algorithm and Nasuella olivacea optimization (NOO) algorithm for solving the problem. Furcifer - inspired optimization (FIO) algorithm designed by emulating the common stalking activities of Furcifer. In the proposed FIO procedure, Furcifer ramble all over the examination region for stalking the quarry. Furcifer search for every single probable area in the examination domain, and use their globular eyeball to analysis widespread range of examination. As soon as the quarry identified, Furcifer use the lengthened and tenacious tongue rapidly seize up the quarry. An acclimatizing element employed to augment examination in the exploration region. Furcifer eyeballs are self-reliantly flexible and able to determine the examination region to discover the quarry. Furcifer eyeballs are able to stare in twofold divergent means concomitantly. In autonomous mode, each eyeball can alter the consideration rendering to the position in synchronized approach. This permits Furcifer to identify dual divergent things in analogous period, to determine the quarry. Furcifer eyeballs will highlighting headlong in harmonization manner, which gives a round hallucination of the quarry and this feature authorize the Furcifer to view rotund their physiques. Nasuella olivacea optimization (NOO) algorithm based on the Nasuella olivacea stalking performance on Ctenosaura bakeri and how Nasuella olivacea flee from hunters. In NOO algorithm, Nasuella olivacea deliberated as population associates of the procedure. The location of each Nasuella olivacea in the examination region controls the rate of the decision parameters. In the preliminary segment of modernizing the population of Nasuella, olivacea in the examination region designed by emulating the Nasuella olivacea stratagem of confronting Ctenosaura bakeri. In this stratagem, a cluster of Nasuella olivacea climbs on the branches of the tree, and then threaten the Ctenosaura bakeri, sequentially the remaining Nasuella olivacea will wait under the branches of tree on the ground once the Ctenosaura bakeri fell on the ground in-group mode the Nasuella olivacea will hunt it. This stratagem tips Nasuella olivacea to passage to dissimilar locations in the examination region and it augments the exploration aptitude of the algorithm. In NOO design, the location of the preeminent associate of the population presumed to be the location of the Ctenosaura bakeri. It is presumed that partial number of Nasuella olivacea climb on the branches of the tree and remaining Nasuella olivacea will wait for the Ctenosaura bakeri to tumble to the ground. Furcifer - inspired optimization (FIO) algorithm and Nasuella olivacea optimization (NOO) algorithm tested in 23 benchmark functions, IEEE 30 and 57 bus systems.

Problem Formulation

Active Power loss is foremost problem in the electrical transmission network. It is very much vital to diminish the loss, thus economic operation of the system is accomplished. Important functional objective of the Loss shrinking problem is methodically delineated as,

$$\mathrm{Min}\ \tilde{F}(\bar{g},\bar{h}) \quad (1)$$

$$M(\bar{g},\bar{h}) = 0 \quad (2)$$

$$N(\bar{g},\bar{h}) = 0 \quad (3)$$

Then the control $(\bar{g})$and dependent $(\bar{h})$vectors defined as,

$$g = [VLG_1, .., VLG_{Ng}; QC_1, .., QC_{Nc}; T_1, .., T_{N_T}] \quad (4)$$

$$h = [PG_{slack}; VL_1, .., VL_{N_{Load}}; QG_1, .., QG_{Ng}; SL_1, .., SL_{N_T}] \quad (5)$$

Q_c → reactive power compensator
T → Transformer tap
V_g → Generator voltage
PG_{slack} → Slack generator
V_L → Voltage in transmission lines
Q_G → Reactive power generator

Fitness functions defined as follows,

$$F_1 = P_{Min} = \mathrm{Min}\left[\sum_{m}^{NTL} G_m \left[V_i^2 + V_j^2 - 2 * V_i V_j \cos\varnothing_{ij}\right]\right] \quad (6)$$

$$F_2 = \mathrm{Min}\left[\sum_{i=1}^{N_{LB}} \left|V_{Lk} - V_{Lk}^{desired}\right|^2 + \sum_{i=1}^{Ng} \left|Q_{GK} - Q_{KG}^{Lim}\right|^2\right] \quad (7)$$

$$F_3 = \text{Minimize } L_{MaxImum} \quad (8)$$

S_L → Apparent power

$$L_{Max} = \mathrm{Max}[L_j]; j = 1; N_{LB} \quad (9)$$

$$L_{Max} = \mathrm{Max}\left[1 - [Y_1]^{-1}[Y_2] \times \frac{V_i}{V_j}\right] \quad (10)$$

Parity constraints

$$0 = PG_i - PD_i - V_i \sum_{j\in N_B} V_j \left[G_{ij}\cos[\varnothing_i - \varnothing_j] + B_{ij}\sin[\varnothing_i - \varnothing_j]\right] \quad (11)$$

$$0 = QG_i - QD_i - V_i \sum_{j\in N_B} V_j \left[G_{ij}\sin[\varnothing_i - \varnothing_j] + B_{ij}\cos[\varnothing_i - \varnothing_j]\right] \quad (12)$$

Disparity constraints

$$P_{gsl}^{min} \le P_{gsl} \le P_{gsl}^{max} \quad (13)$$

$$Q_{gi}^{min} \le Q_{gi} \le Q_{gi}^{max}, i \in N_g \quad (14)$$

$$VL_i^{min} \le VL_i \le VL_i^{max}, i \in NL \quad (15)$$

$$T_i^{min} \le T_i \le T_i^{max}, i \in N_T \quad (16)$$

$$Q_c^{min} \le Q_c \le Q_C^{max}, i \in N_C \quad (17)$$

$$|SL_i| \le S_{L_i}^{max}, i \in N_{TL} \quad (18)$$

$$VG_i^{min} \le VG_i \le VG_i^{max}, i \in N_g \quad (19)$$

$$\text{Multi objective fitness (MOF)} = F_1 + r_i F_2 + uF_3 = F_1 + \left[\sum_{i=1}^{NL} x_v \left[VL_i - VL_i^{min}\right]^2 + \sum_{i=1}^{NG} r_g \left[QG_i - QG_i^{min}\right]^2\right] + r_f F_3 \quad (20)$$

Furcifer - Inspired Optimization Algorithm

Furcifer - inspired optimization (FIO) algorithm designed by emulating the common stalking activities of Furcifer. In FIO procedure, Furcifer [20, 21] will ramble in the examination region, to stalk the quarry. Furcifer search for every single probable area in the examination domain, and use their globular eyeball to analysis widespread range of examination. As soon as the quarry identified, Furcifer use the lengthened and tenacious tongue rapidly seize up the quarry. An acclimatizing element employed to augment examination in the exploration region. Furcifer eyeballs are self-reliantly flexible and able to determine the examination region to discover the quarry. Furcifer eyeballs are able to stare in twofold divergent means concomitantly. In autonomous mode, each eyeball can alter the consideration rendering to the position in synchronized approach. This permits Furcifer to identify dual divergent things in analogous period, to determine the quarry. Furcifer eyeballs will highlighting headlong in harmonization manner, which gives a round hallucination of the quarry and this feature authorize the Furcifer to view rotund their physiques. Once a Furcifer signs a quarry, both eye balls similarly unite on the analogous way for a flawless vision. Consequently, Furcifer passages in the direction of the position of the quarry. Furcifer principally nourish by discharging their tenacious tongue to confiscation the quarry. Furcifer hold gluey tongues and quarry will be apprehended instantly come into connexion. It is like humid bond and fix, everyplace the Furcifer rapidly create a minor twitch with a rapid up degree. Furcifer populace created in examination region, with each Furcifer represents a candidate solution and the position of Furcifer in the examination zone demarcated as,

$$f_t^i = [f_{t,1}^i, f_{t,2}^i, f_{t,3}^i, \dots, f_{t,d}^i] \qquad (21)$$

$i = 1,2,\dots,n$

$f_{t,d}^i \rightarrow Location\ of\ the\ \text{“}ith\text{”}\ Furcifer$

Rendering to the quantity of Furcifer, initial population created randomly in the exploration region as follows,

$$f^i = min_j + Rand \times \left((max)_j - (min)_j\right) \qquad (22)$$

$(max)_j\ and (min)_j\ are\ the\ limits$

$Rand \in [0,1]$

Furcifer will position in the current location, since its solution brilliance is additional proficient than to the fresh one.

The searching movement of the Furcifer scientifically designed as,

$$f_{t+1}^{i,j} = \begin{cases} f_t^{i,j} + Q_1(L_t^{i,j} - U_t^j)O_2 + Q_2(U_t^j - f_t^{i,j})O_1\ , \\ O_i \geq E \\ f_t^{i,j} + \varphi\left((max^j - min^j)O_3 + min^j\right)w(O - 0.50)\ , \\ O_i < E \end{cases} \qquad (23)$$

$f_{t+1}^{i,j}\ is\ location\ of\ the\ ith\ Furcifer$

$in\ jth\ (dimesion)\ at\ iter\ (t+1)$

$f_t^{i,j} present\ location\ of\ the$

$ith\ Furcifer\ in\ jth\ (dimesion) at\ \ iter\ (t)$

$L_t^{i,j}\ is\ current\ position$

$U_t^j\ universal\ best\ location$

$Q_1\ and\ Q_2\ are\ positive\ numbers$

$to\ regulate\ the\ exploration$

$O_1\ , O_2\ and\ O_3\ are\ random\ numbers$

$\varphi\ is\ iteration\ function$

$w(O - 0.50) \rightarrow regulate\ the\ exploration$

$and\ exploitaion\ direction\ \in [-1,1]$

$Eis\ the\ probability\ of\ the$

$Furcifer\ perceiving\ the\ quarry$

$$A(O_1, O_2) = B + O_2(C - D) + O_1(D - B) \qquad (24)$$

Where $A, B, Cand\ D\ are\ the\ \ locations\ in\ the\ region$

$$H(O_1) = O_1C + (1 - O_1)D \qquad (25)$$

$$A(O_1, O_2) = O_2H + (1 - O_2)B\ ,\ \ 0 \leq O_2 \leq 1 \qquad (26)$$

$$f_{t+1}^{i,j} = \ A(O_1, O_2), f_t^{i,j} = B, L_t^{i,j} = C, U_t^j = D \qquad (27)$$

Once $E < 0.1$ then, the exploring competence on the way to different position of Furcifer heightened

$$\vartheta = \gamma e(-\alpha t/T)^{\beta} \qquad (28)$$

$\alpha, \beta, \gamma\ \rightarrow regulate\ the\ exploration\ and\ exploitaion$

Furcifer own the competence to recognize the position of quarry by means of the swirl aspect of the eyeballs, and this characteristic creates to identify the prey in round directions. Furcifer will streamline their location with reference to the position of the quarry. Unsurprisingly Furcifer will rotate and headway on the way to the quarry.

Location of the Furcifer will be untangled with alignment to the axis of gravity is demarcated as,

$$\vec{J} = K_2 - K_1 \qquad (29)$$

$$\vec{J} = K_2^t\ K_1^t \qquad (30)$$

$K_2\ and\ K_1\ are\ the\ locations\ of\ Furcifer$

$\vec{J} \rightarrow position\ in\ the\ region$

Swirl will occurred rendering to the quarry and it demarcated as,

$$\vec{J} = (J_X, J_Y, J_Z) \qquad (31)$$

Phase drive of the Furcifer designated as,

$$\overrightarrow{J_2} = (J2_X, J2_Y, J2_Z) \qquad (32)$$

Swirl gyration angle $(\emptyset)$ demarcated as,

$$Tan(\emptyset) = -M_Y/M_X \qquad (33)$$

Swirl gyration rendering to segment of (f) demarcated as,

$$J2f = \sqrt{J_X^2 - J_Y^2} \qquad (34)$$

The orientation angle $(\omega)$of the phase demarcated as,

$$Cos(\omega) = -J_Z/|J| \qquad (35)$$

Consequently, the succeeding location demarcated as,

$$J3_Z = |J| \qquad (36)$$

Fresh location of the Furcifer rationalized by,

$$f_{t+1}^i = fN_t^i + \overrightarrow{f_t^i} \qquad (37)$$

$f_{t+1}^{i}\ is\ \ fresh\ location\ of\ Furcifer$

$\overrightarrow{f_t^i}\ is\ current\ location\ of$
$\ Furcifer\ before\ the\ Swirl$

$fN_t^i\ is\ Swirl\ centered\ coordinate\ of\ Furcifer$

$fN_t^i = \ Swirl\ matrix \times$
$fSwirl\ centered\ coordinate_t^i$

$fSwirl\ centered\ coordinate_t^i = f_t^i - \overrightarrow{f_t^i}$

$f_t^i\ is\ the\ current\ location\ of\ Furcifer$

$$\omega = O \cdot w(O - 0.5) \times 180^0 \tag{38}$$

$O \in [0,1]$

$w(O - 0.5) \in [-1,1]$

$Swirl\ matrix$ in X, Y facet is demarcated as,

$$Swirl\ matrix_X = \begin{bmatrix} 1 & 0 & 0 \\ 0 & cos\varphi & -sin\varphi \\ 0 & sin\varphi & cos\varphi \end{bmatrix} \tag{39}$$

$$Swirl\ matrix_Y = \begin{bmatrix} cos\omega & 0 & sin\omega \\ 0 & 1 & 0 \\ -sin\omega & 0 & cos\omega \end{bmatrix} \tag{40}$$

Furcifer pursuit the quarry and when it is disproportionately adjacent and the Furcifer is handy to the quarry taken as premium Furcifer (optimal one). Furcifer apply its tongue in order to confiscate the quarry. Henceforward, its position is rationalized slightly, as it can tumble its tongue as twin as its facet. This tactic ropes the Furcifer to search the exploration region by efficaciously grabbing the quarry. The rapidity of Furcifer tongue when it tumbles in the route of quarry methodically demonstrated as,

$$S_{t+1}^{i,j} = \theta S_t^{i,j} + T_1\left(D_t^j - f_t^{i,j}\right)O_1 + T_2\left(C_t^j - f_t^{i,j}\right)O_2 \tag{41}$$

$S_{t+1}^{i,j}\ isfresh\ velocity\ of\ Furcifer$

$f_t^{i,j}\ is\ current\ location\ of\ Furcifer$

$T_1\ and\ T_2\ are\ positive\ contants\ used\ for\ regulation$

$$\theta = (1 - t/T)^{\left(\sigma\sqrt{(t/T)}\right)} \tag{42}$$

The location of the Furcifer tongue as soon as passages in the course of quarry signify, tacitly, the position of the Furcifer and it can be premeditated with alignment of three equivalence of motion as follows,

$$f_{t+1}^{i,j} = f_t^{i,j} + \frac{\left(\left(S_t^{i,j}\right)^2 - \left(S_{t-1}^{i,j}\right)^2\right)}{2W} \tag{43}$$

$S_{t-1}^{i,j}\ is\ \ previous\ velocity\ of\ Furcifer$

$w\ \ \rightarrow speeding\ up\ ratio$

$$W = 3000\ \times \left(1 - e^{-\log(t)}\right) \tag{44}$$

In order to avoid the local optima, a crossover grounded complete learning approach employed to create new location through crossover mutation on the present best entity as follows,

$$newL_t^{i,j} = \begin{cases} O_1L_t^{i,j} + (1 - O_1)L_t^{i,j} + v\left(L_t^{i,j} - L_t^{1,j}\right) \\ ,if\ rand < \tau_{cross\ over\ probability} \\ O_2L_t^{i,j} + (1 - O_2)L_t^{i,j1}, \\ otherwise \end{cases} \tag{45}$$

$v \in [0,1]$

$O_1, O_2 \rightarrow 0\ to\ 1$

$\tau_{cross\ over\ probability} \in [0,1]$

$L_t^{i,j} \rightarrow present\ entity\ location$

Balancing of the exploration and exploitation of the search done as follows,

$$Q_1 = 1/2\left(sin(2\pi * freq * t)\frac{t}{iter.max} + 1\right) \tag{46}$$

$Q_1 \rightarrow regulate\ the\ location\ of\ the\ Furcifer$

$t\ is\ present\ iteration$

```
a. Start
b. Set the parameter values
c. Engender the location of the Furcifer
   $f^i = \ min_j + Rand \times \left((max)_j - (min)\ _j\right)$
d. Produce the Furcifer tongue rapidness
e. Assess the Furcifer location
f. $while\ (t < T)\ do$
g. $Define\ the\ element\ \vartheta$
   $\vartheta = \gamma e(-\alpha t/T)^{\beta}$
h. Skeleton the element $\theta$
   $\theta = (1 - t/T)^{\left(\sigma\sqrt{(t/T)}\right)}$
i. $Designate\ \ the\ element\ W$
   $W = 3000\ \times \left(1 - e^{-\log(t)}\right)$
j. $For\ i = 1\ to\ n\ do$
k. $For\ j = 1\ to\ n\ do$
l. Calculate the search activity of the Furcifer
   $f_{t+1}^{i,j} = \begin{cases} f_t^{i,j} + Q_1\left(L_t^{i,j} - U_t^j\right)O_2 \\ +Q_2\left(U_t^j - f_t^{i,j}\right)O_1\ \ ,O_i \geq E \\ f_t^{i,j} + \\ \varphi\left((max^j - min^j)O_3 + min^j\right) \\ w(O - 0.50)\ \ ,O_i < E \end{cases}$
m. End if
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n.  End for
o.  $For\ i = 1\ to\ n\ do$
p.  Fresh location of Furcifer is engendered
    $f_{t+1}^{i} = fN_t^i + \overrightarrow{f_t^i}$
q.  End for
r.  $For\ i = 1\ to\ n\ do$
s.  $For\ j = 1\ to\ n\ do$
t.  Define rapidity of Furcifer tongue
    $S_{t+1}^{i,j} = \theta S_t^{i,j} + T_1(D_t^j - f_t^{i,j})O_1 + T_2(C_t^j - f_t^{i,j})O_2$
    $f_{t+1}^{i,j} = f_t^{i,j} + \frac{\left((s_t^{i,j})^2 - (s_{t-1}^{i,j})^2\right)}{2W}$
u.  End for
v.  Amend the location of Furcifer rendering to the limits
w.  Calculate the fresh location of Furcifer
x.  Streamline the location of Furcifer
y.  $newL_t^{i,j} = \begin{cases} O_1 L_t^{i,j} + (1 - O_1)L_t^{i,j} + v(L_t^{i,j} - L_t^{1,j}) \\ ,if\ rand < \tau_{cross\ over\ probability} \\ O_2 L_t^{i,j} + (1 - O_2)L_t^{i,j1} \\ ,otherwise \end{cases}$
z.  $if\ \left(fit(newL_t^{i,j}) < fit(L_t^{i,j})\right)\ do$
aa. $L_t^{i,j} = newL_t^{i,j}$
bb. $t = t + 1$
cc. End while
dd. output the best solution
ee. End
```

Nasuella olivacea optimization algorithm

Nasuella olivacea optimization (NOO) algorithm based on the Nasuella olivacea [21] stalking performance on Ctenosaura bakeri and how Nasuella olivacea flee from hunters.

In NOO algorithm, Nasuella olivacea deliberated as population associates of the procedure. The location of each Nasuella olivacea in the examination region controls the rate of the decision parameters. Preliminary location of the Nasuella olivacea in the examination region arbitrarily initialized.

$$Z_i;\ z_{i,j} = min_j + random \cdot (max_j - min_j) \tag{47}$$

$i = 1,2,3,4,..,N$

$j = 1,2,3,4,..,m$

$Z_i \rightarrow location\ of\ the\ ith\ Nasuella\ olivacea\ in\ examination\ region$

$N \rightarrow quantity\ of\ Nasuella\ olivacea$

$m \rightarrow\ decision\ parameters$

$random \in [0,1]$

$max_j and\ min_j\ are\ the\ limits$

Nasuella olivacea population in matrix form as follows,

$$P = \begin{bmatrix} P_1 \\ \vdots \\ P_i \\ \vdots \\ P_N \end{bmatrix}_{N\times m} = \begin{bmatrix} p_1 & \cdots & p_{1,m} \\ \vdots & \ddots & \vdots \\ p_{N,1} & \cdots & p_{N,m} \end{bmatrix}_{N\times m} \tag{48}$$

The assignment of candidate resolutions in decision parameters tips to the assessment of dissimilar standards.

$$Q = \begin{bmatrix} Q_1 \\ \vdots \\ Q_i \\ \vdots \\ Q_N \end{bmatrix}_{N\times 1} = \begin{bmatrix} Q(P_1) \\ \vdots \\ Q(P_i) \\ \vdots \\ Q(P_N) \end{bmatrix}_{N\times 1} \tag{49}$$

Course of modernizing the location of Nasuella olivacea is depend on the stalking performance. In the preliminary segment of modernizing the population of Nasuella, olivacea in the examination region designed by emulating the Nasuella olivacea stratagem of confronting Ctenosaura bakeri. In this stratagem, a cluster of Nasuella olivacea climbs on the branches of the tree, and then threaten the Ctenosaura bakeri, sequentially the remaining Nasuella olivacea will wait under the branches of tree on the ground once the Ctenosaura bakeri fell on the ground group mode the Nasuella olivacea will hunt it. This stratagem tips Nasuella olivacea to passage to dissimilar locations in the examination region and it augments the exploration aptitude of the algorithm. In NOO design, the location of the preeminent associate of the population presumed to be the location of the Ctenosaura bakeri. It presumed that partial number of Nasuella olivacea climb on the branches of the tree and remaining Nasuella olivacea would wait for the Ctenosaura bakeri to tumble to the ground. Consequently, the location of the Nasuella olivacea expanding from the branches of the tree scientifically replicated as follows,

$$Z_i^{L1}; z_{i,j}^{L1} = z_{i,j} + random \cdot \left(Cb_j - U \cdot z_{i,j}\right) \qquad (50)$$

$Cb_j \rightarrow\ Ctenosaura\ bakeri$

$i = 1,2,3,4,..,[N/2]$

$j = 1,2,3,4,..,m$

Once Ctenosaura bakeri falls on the ground, it is located in an arbitrary position in the examination region. Grounded on this arbitrary location, Nasuella olivacea on the ground passage in the examination region and it simulated as follows,

$$Cb^{Ground};\ Cb_j^{Ground} = min_j + random \cdot \left(max_j - min_j\right) \qquad (51)$$

$$Z_i^{L1}; z_{i,j}^{L1} = \begin{cases} z_{i,j} + rand \cdot \left(Cb_j^{Ground} - U \cdot z_{i,j}\right), Q_{Cb}^{Ground} < Q_i \\ \quad z_{i,j} + rand \cdot \left(z_{i,j} - Cb_j^{Ground}\right), Else \end{cases} \qquad (52)$$

$i =\ [N/2] + 1, [N/2]\ + 2, \dots, \mathrm{N}$

$j = 1,2,3,4,..,m$

The new-fangled location premeditated for each Nasuella olivacea is adequate for the modernization procedure if it progresses the rate of the objective function, or else, the Nasuella olivacea will residues in the preceding location.

$$Z_i = \begin{cases} Z_i^{L1}, Q_i^{L1} < Q_i \\ Z_i, otherwise \end{cases} \qquad (53)$$

$Z_i^{L1} \rightarrow new\ location\ of\ the\ ith\ Nasuella\ olivacea$

$Q_i^{L1} \rightarrow objective\ functional\ value$

$random \in [0,1]$

$U \in \{1,2\}$

$Cb_j^{Ground} \rightarrow$

$location\ of\ the\ Ctenosaura\ bakeri\ \ on\ the\ ground$

The subsequent segment of the procedure in modernizing the location of Nasuella olivacea in the examination region scientifically designed grounded on the regular actions of Nasuella olivacea while facing hunters and flee from the hunters. As soon as a hunter attacks a Nasuella olivacea, then it flee from its location, Nasuella olivacea passages in this stratagem, which tip, to it being in a harmless location neighboring to its present location, this actions designates NOO algorithms exploitation capability in the local search.

$$min_j^l = \frac{min_j}{t}, max_j^l = \frac{max_j}{t} \qquad (54)$$

$l \rightarrow Local$

$t = 1,2,3,..,T$

$$Z_i^{L2}; z_{i,j}^{L2} = z_{i,j} + (1 - 2r) \cdot \left(min_j^l + Random \cdot \left(max_j^l - min_j^l\right)\right) \qquad (55)$$

$i = 1,2,3,4,..,N$

$j = 1,2,3,4,..,m$

The new-fangled location premeditated for each Nasuella olivacea is adequate for the modernization procedure if it progresses the rate of the objective function, or else, the Nasuella olivacea will residues in the preceding location.

$$Z_i = \begin{cases} Z_i^{L2}, Q_i^{L2} < Q_i \\ Z_i, otherwise \end{cases} \qquad (56)$$

$Z_i^{L2} \rightarrow new\ location\ of\ the\ ith\ Nasuella\ olivacea$

$Q_i^{L2} \rightarrow objective\ functional\ value$

$random \in [0,1]$

$max_j^l and\ min_j^l\ are\ local\ limits$

$max_j and\ min_j\ are\ the\ limits$

$of\ the\ decision\ parameters$

Space (distance) computed as,

$$Distance\ \left(z_i, z_j\right)\ = \left\|z_i, z_j\right\| = \sqrt{\sum_{k=1}^{n}\left(z_{ik} - z_{jk}\right)^2} \qquad (57)$$

The selecting possibility (CP) demarcated as follows,

$$CP_j = \frac{B(Q_j)}{\sum_{i=1}^{n} B(Q_j)} \qquad (58)$$

The phase size is proportionate to the distance defined as,

$$Q_i = \left(\frac{I_{average}}{I_{minimum}}\right) \times \sigma^2 \times ED_{i,b} \times \varphi \qquad (59)$$

a. Start

b. Set the parameters

c. Engender the Nasuella olivacea population

d. Initialize the Nasuella olivacea location

e. $For\ t = 1{:}T$

f. Based on the preeminent associate, modernize the location of Ctenosaura bakeri

g. Employ the Exploration segment \\ Attacking and hunting stratagem\\

h. $For\ i = 1{:}[N/2]$

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i.  Compute the new location of ith Nasuella olivacea
j.  $Z_i^{L1}; z_{i,j}^{L1} = z_{i,j} + random \cdot (Cb_j - U \cdot z_{i,j})$
k.  Update the location of ith Nasuella olivacea
l.  $Z_i = \begin{cases} Z_i^{L1}, Q_i^{L1} < Q_i \\ Z_i, otherwise \end{cases}$
m.  End for
n.  $For\ i = 1 + [N/2]: N$
o.  $Compute\ the\ random\ location\ of\ Ctenosaura\ bakeri$
p.  $Cb^{Ground};\ Cb_j^{Ground} = min_j + random \cdot (max_j - min_j)$
q.  Compute the new location of ith Nasuella olivacea
r.  $Z_i^{L1}; z_{i,j}^{L1} = \begin{cases} z_{i,j} + random \cdot (Cb_j^{Ground} - U \cdot z_{i,j}), Q_{Cb}^{Ground} < Q_i \\ z_{i,j} + random \cdot (z_{i,j} - Cb_j^{Ground}), Else \end{cases}$
s.  Update the location of ith Nasuella olivacea
t.  $Z_i = \begin{cases} Z_i^{L1}, Q_i^{L1} < Q_i \\ Z_i, otherwise \end{cases}$
u.  End for
v.  Employ the Exploitation segment \\ Flee away from hunters\\
w.  Compute the local limits for the decision parameters
x.  $min_j^l = \frac{min_j}{t}, max_j^l = \frac{max_j}{t}$
y.  $For\ i = 1: N$
z.  Compute the new location of ith Nasuella olivacea
aa. $Z_i^{L2}; z_{i,j}^{L2} = z_{i,j} + (1 - 2r) \cdot \left(min_j^l + Random \cdot (max_j^l - min_j^l)\right)$
bb. $Distance\ (z_i, z_j) = \|z_i, z_j\| = \sqrt{\sum_{k=1}^{n} (z_{ik} - z_{jk})^2}$
cc. $CP_j = \frac{B(Q_j)}{\sum_{i=1}^{n} B(Q_j)}$
dd. $Q_i = \left(\frac{I_{average}}{I_{minimum}}\right) \times \sigma^2 \times ED_{i,b} \times \varphi$
ee. Update the location of ith Nasuella olivacea
ff. $Z_i = \begin{cases} Z_i^{L2}, Q_i^{L2} < Q_i \\ Z_i, otherwise \end{cases}$
gg. $End\ for$
hh. Save the preeminent values
ii. $t = t + 1$
jj. Output the best solution
kk. End
```

Simulation Results

Furcifer - inspired optimization (FIO) algorithm and Nasuella olivacea optimization (NOO) algorithm corroborated in 23 benchmark functions (Main 7-Unimodal, succeeding 6-Multimodal, concluding 10-fixed-dimension multimodal) [13]. Evaluation done with enriched salp swarm algorithm (ES) and salp swarm (SP). Table I displays the outcome of FIO, NOO in benchmark test functions.

Table I. outcome of FIO and NOO

Fi	ES [13]	SP [13]	FIO	NOO
Fi1	6.38×10^{-12}	6.96×10^{-9}	6.26×10^{-12}	6.26×10^{-12}
Fi2	3.08×10^{-7}	5.48×10^{-6}	3.03×10^{-7}	3.03×10^{-7}
Fi3	2.53×10^{-1}	4.35×10^{-10}	2.35×10^{-1}	2.35×10^{-1}
Fi4	6.71×10^{-7}	1.19×10^{-5}	6.57×10^{-7}	6.57×10^{-7}
Fi5	4.110208	117.4396	4.110010	4.110010
Fi6	3.19×10^{-10}	4.50×10^{-10}	3.09×10^{-10}	3.09×10^{-10}
Fi7	2.23×10^{-5}	0.002002	2.08×10^{-5}	2.08×10^{-5}
Fi8	−2877.61	−3052.87	−2861.01	−2861.01
Fi9	1.01×10^{-12}	22.85084	1.04×10^{-12}	1.04×10^{-12}
Fi10	4.79 ×	0.810233	4.51×	4.51×

	10^{-7}		10^{-7}	10^{-7}
Fi11	5.91×10^{-12}	0.33718	5.73×10^{-12}	5.73×10^{-12}
Fi12	2.56×10^{-12}	0.051897	2.37×10^{-12}	2.37×10^{-12}
Fi13	0.000366	0.001099	0.000335	0.000335
Fi14	0.998004	0.998004	0.996000	0.996000
Fi15	0.000307	0.000829	0.000283	0.000283
Fi16	−1.03163	−1.03163	−1.03145	−1.03145
Fi17	0.397887	0.397887	0.397861	0.397861
Fi18	3	3	3	3
Fi19	−3.86278	−3.86278	−3.86243	−3.86243
Fi20	−3.23084	−3.21497	−3.23051	−3.23051
Fi21	−10.1532	−8.80506	−10.1523	−10.1523
Fi22	−10.0486	−8.46635	−10.0454	−10.0454
Fi23	−10.5364	−9.28557	−10.5358	−10.5358

Furcifer - inspired optimization (FIO) algorithm and Nasuella olivacea optimization (NOO) algorithm tested in IEEE 30 bus system [12]. Table II shows the Active power loss (AL (MW)), Power abnormality (PA (PU)) and Power Constancy (PC (PU)). Figures 1 to 3 gives the assessment of AL, PA and PC.

Table II. Assessment of loss

Method	AL (MW)	PA(PU)	PC(PU)
AMPSOTVIW [7]	4.5213	0.1038	0.1258
AGPSOTVAC [7]	4.6862	0.2064	0.1499
IRPSOTVAC [7]	4.6862	0.1354	0.1271
ERPSOCF [7]	4.5900	0.1287	0.1261
AGPSO [7]	4.5594	0.1202	0.1264
DESWTPSO [7]	4.5629	0.1614	0.1488
ERSWTPSO [7]	4.9408	0.1539	0.1394
PEGPSO [7]	4.9239	0.0892	0.1241
MTTLBO [8]	4.9059	0.0856	0.1191
AGTLBO [8]	4.5777	0.0913	0.1180
PEALO [9]	4.5142	0.1220	0.1161
PEABC [9]	4.5275	0.0890	0.1161
PEGWO [9]	4.9014	0.0877	0.1242
MTBBA [9]	4.5789	0.1232	0.1252
BSCFS [10]	4.5135	0.0896	0.1252
AEISFS [11]	4.5284	0.0891	0.1245
FIO	4.4582	0.0813	0.1251
NOO	4.4587	0.0818	0.1248

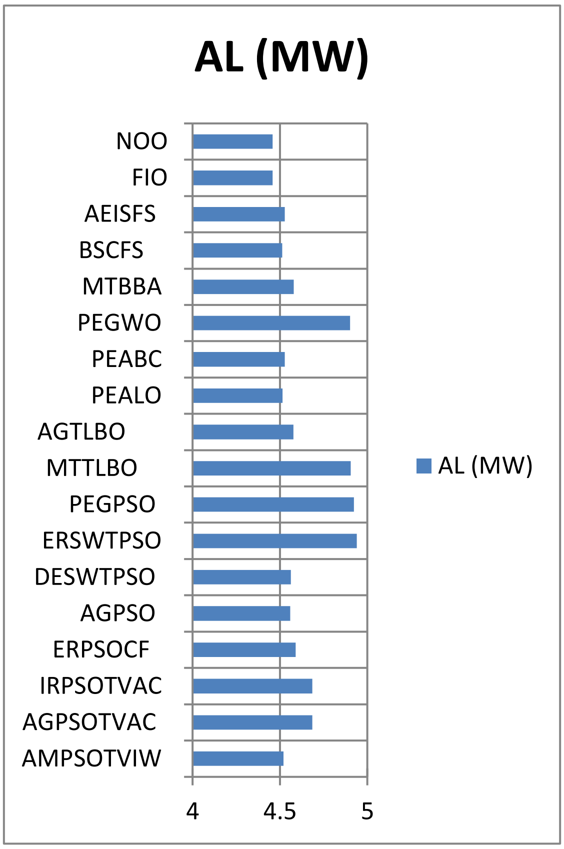

Figure 1. Evaluation of loss

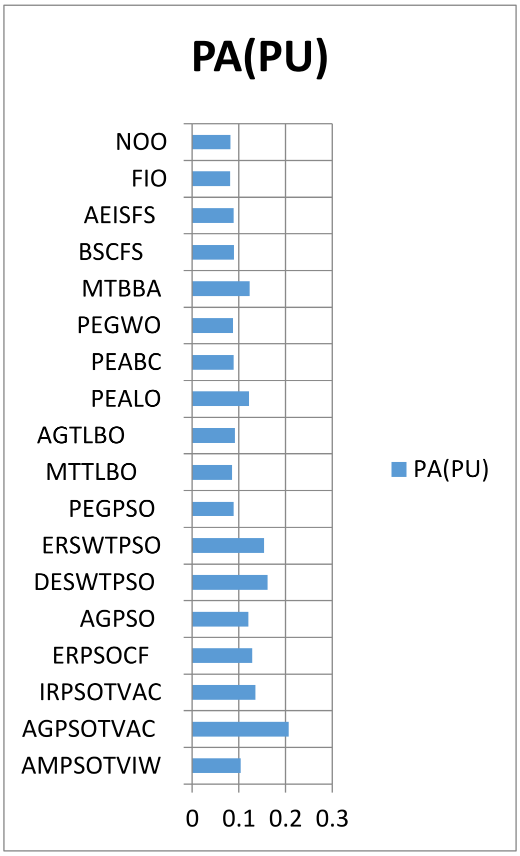

Figure 2. Assessment of deviancy

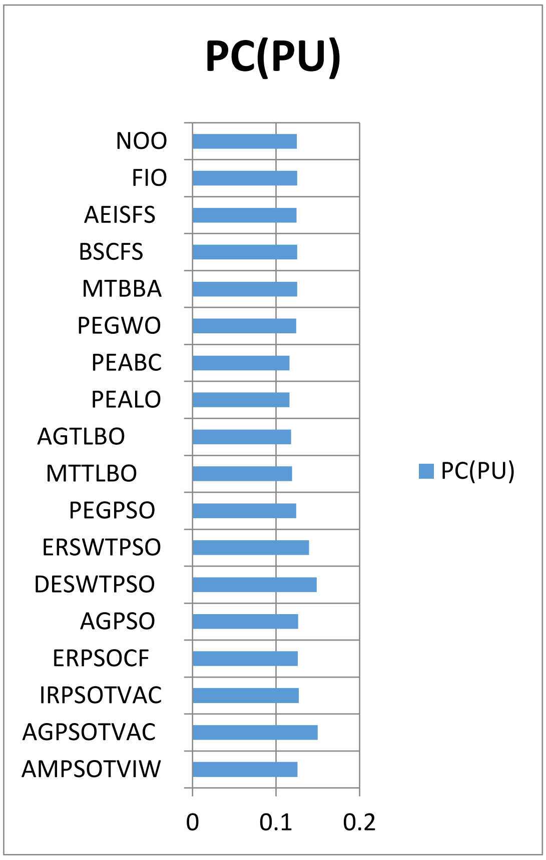

Figure 3. Assessment of resilience

Furcifer - inspired optimization (FIO) algorithm and Nasuella olivacea optimization (NOO) algorithm is verified in IEEE 57 bus system [6]. Table III shows the Active power loss (AL (MW)), Power abnormality (PA (PU)) and Power Constancy (PC (PU)). Figures 4 to 6 gives the valuation of assessment of AL, PA and PC.

Table III. Assessment of Active loss

Technique	AL (MW)	PA(PU)	PC(PU)
PRCOA [1]	22.376	0.6051	0.25169
PRCOA1[1]	22.383	0.6155	0.2583
PDWCA [1]	26.0402	0.7309	0.2789
ERSSA [1]	25.3854	0.94	0.29
PRFOA [1]	26.6541	0.7913	0.2831
MDCOA [1]	24.5358	0.6711	0.2757
ERLISAI [2]	26.88	1.0642	0.25297
ERLISAII [2]	26.92	1.072	0.2592
IPISA [2]	26.97	1.0912	0.2798
IMPSO [3]	27.83	1.10	0.30
BSIPSO [3]	27.42	0.896	0.2915
MDFO [4]	24.25	1.0179	0.2824
PRGWA [4]	21.171	1.098	0.2898
PDCGA [5]	25.64	1.091	0.312
MDPSO [5]	25.03	1.13	0.2627
IRPAS [5]	24.90	0.901	0.2789
NOO	20.02	0.6002	0.2585
FIO	20.09	0.6008	0.2579

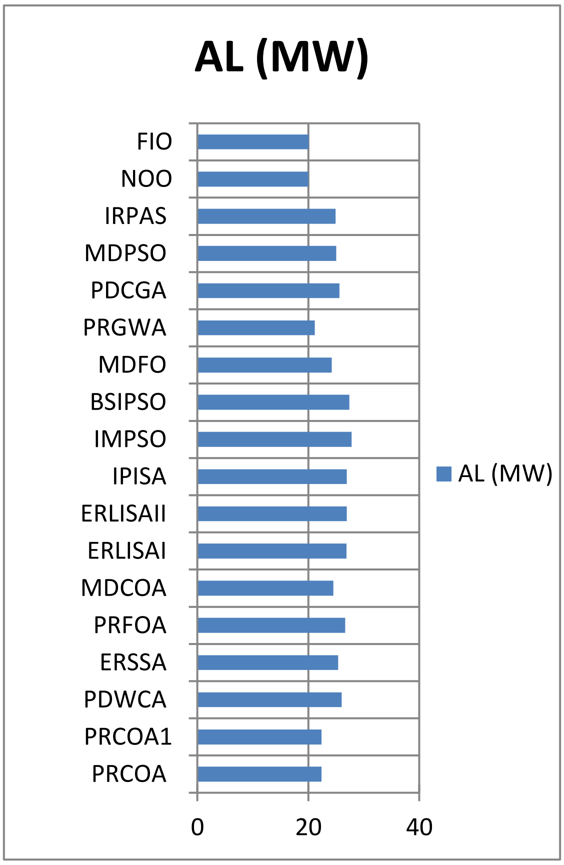

Figure 4. Assessment of loss

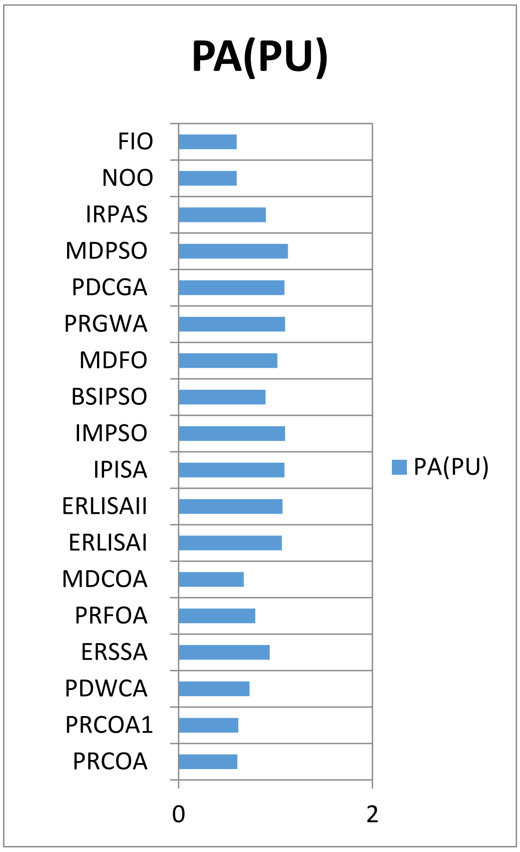

Figure 5. Review of power deviancy

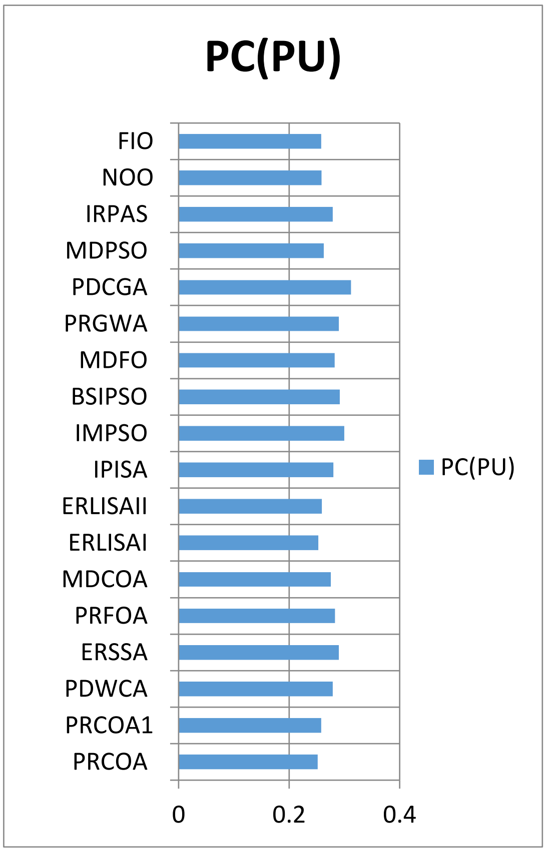

Figure 6. Review of resilience

Conclusion

Furcifer - inspired optimization (FIO) algorithm and Nasuella olivacea optimization (NOO) algorithm condensed the active power loss dexterously. Furcifer own the competence to recognize the position of quarry by means of the swirl aspect of the eyeballs, and this characteristic creates to identify the prey in round directions. Furcifer will streamline their location with reference to the position of the quarry. Unsurprisingly Furcifer will rotate and headway on the way to the quarry. Location of the Furcifer will be untangled with alignment to the axis of gravity. Furcifer pursuit the quarry, when it is disproportionately adjacent and the Furcifer is handy to the quarry and taken as premium Furcifer (optimal one). Furcifer apply its tongue in order to confiscate the quarry. Henceforward, its position is rationalized slightly, as it can tumble its tongue as twin as its facet. This tactic ropes the Furcifer to search the exploration region by efficaciously grabbing the quarry. The rapidity of Furcifer tongue when it tumbles in the route of quarry. In NOO algorithm, Nasuella olivacea deliberated as population associates of the procedure. The location of each Nasuella olivacea in the examination region controls the rate of the decision parameters. Preliminary location of the Nasuella olivacea in the examination region arbitrarily initialized. From EPIS approach space (distance) computed. The new-fangled location premeditated for each Nasuella olivacea is adequate for the modernization procedure if it progresses the rate of the objective function, or else, the Nasuella olivacea will residues in the preceding location.

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