More Particles

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Biologically-Inspired Intelligent Systems

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Particle Swarm Optimization

Objective function $f(\boldsymbol{x})$, $\boldsymbol{x} = (x_1, ..., x_d)^T$
Initialize locations $\boldsymbol{x}_i$ and velocity $\boldsymbol{v}_i$ of n particles.
Find $\boldsymbol{g}^*$ from $\min\{f(\boldsymbol{x}_1), ..., f(\boldsymbol{x}_n)\}$ (at $t = 0$)
while (criterion)
    for loop over all n particles and all d dimensions
    Generate new velocity $\boldsymbol{v}_i^{t+1}$ using equation (7.1)
    Calculate new locations $\boldsymbol{x}_i^{t+1} = \boldsymbol{x}_i^t + \boldsymbol{v}_i^{t+1}$
    Evaluate objective functions at new locations $\boldsymbol{x}_i^{t+1}$
    Find the current best for each particle $\boldsymbol{x}_i^*$
    end for
    Find the current global best $\boldsymbol{g}^*$
    Update $t = t + 1$ (pseudo time or iteration counter)
end while
Output the final results $\boldsymbol{x}_i^*$ and $\boldsymbol{g}^*$

Accelerated PSO (APSO)

APSO Setup

- Can exhibit global convergence
- $\alpha \approx [0.1,0.4]$ & $\beta \approx [0.1,0.7]$, with $\alpha = 0.2$ and $\beta = 0.5$ as initial values (unimodal objectives)
  - α and β should be in scale of variables $\boldsymbol{x}_i$ (& search domain)

- Randomness schedule (i.e., monotonically decreasing fnt.)
  - $\alpha = \alpha_0 e^{-\gamma t}$, or, $\alpha = \alpha_0 \gamma^t$ where $0 < \gamma < 1$

  where $\alpha_0 \approx [0.5,1]$ (initial value), t marks iteration count, and $\gamma = [0.9,0.97]$ (control variable)
  - Tune schedule $\alpha(t)$ to optimization problem of interest

Questions?