

Particle swarm optimization algorithm

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Version : PSOAdvVmax (See documentation for details)

PSO ADVANCED with MAXIMUM VELOCITY CONTROL

■ BODY

```

PSOAdvVmax[Cost_, Spec_, it_: 50, Np_: 20, c_: 2, cc_: 2, Wx_] :=
Module[{CF, Specimen, dim, n, NP, c1, c2, RangeFrom, RangeTo, vMax, gBestVal,
  gBestPos, pBestVal, pBestPos, vfield, pop, fitness, i, j, k, Vmax},
  CF = Cost;
  Specimen = Spec;
  n = it;
  NP = Np;
  c1 = c;
  c2 = cc;
  dim = Dimensions[Specimen, 2][[1]];
  RangeFrom = Specimen[[All, 2, 1]];
  RangeTo = Specimen[[All, 2, 2]];
  Vmax = Wx;
  gBestVal = CF[(RangeTo / 2)];
  gBestPos = RangeTo / 2;
  pBestVal = Table[CF[RangeFrom / 2], {NP}];
  pBestPos = Table[RangeFrom / 2, {NP}];
  pop = Table[Table[Random[Specimen[[dim, 1]],
    {Specimen[[dim, 2, 1]], Specimen[[dim, 2, 2]]}], {dim}], {NP}];
  vfield = Table[Table[0, {dim}], {NP}];
  Table[
    Table[
      vfield[[j]] =
        vfield[[j]] + c1 * RandomReal[{0, 1}] * (pBestPos[[j]] - pop[[j]]) +
        c2 * RandomReal[{0, 1}] * (gBestPos - pop[[j]]);

      Table[
        If[Abs[vfield[[j, k]]] > Vmax[[k]], vfield[[j, k]] = Vmax[[k]]];
        , {k, 1, dim, 1}
      ];

      pop[[j]] = pop[[j]] + vfield[[j]];
      Table[
        If[pop[[j, k]] < RangeFrom[[k]] || pop[[j, k]] > RangeTo[[k]],
          pop[[j, k]] = RandomReal[{RangeFrom[[k]], RangeTo[[k]]}];
        , {k, 1, dim, 1}];
      fitness = CF[pop[[j]]];
      If[fitness < pBestVal[[j]],
        pBestVal[[j]] = fitness; pBestPos[[j]] = pop[[j]]];
      If[fitness < gBestVal, gBestVal = fitness; gBestPos = pop[[j]]];

      , {j, 1, NP, 1}];
    , {i, 1, n, 1}];
  Return[{gBestVal, gBestPos}];
];

```

■ Usage example

■ Cost Function definition

Note: Input to function is array of numbers. Output is single number.

```
schwefel[vstup_] := Module[{pole, i},
  pole = vstup;
  If[VectorQ[pole] != True, pole = {pole, 0}];
  Table[
    pole[[i]] = -pole[[i]] * Sin[Sqrt[Abs[pole[[i]]]]], {i, 1, Length[pole]};
  Return[Total[pole]];
]
CF = schwefel;
```

■ Specimen definition

Note : Specimen format $\{\{Type, \{From, To\}\}\}$

```
Specimen = {{Real, {-512, 511}}, {Real, {-512, 511}}};
```

or (these are equivalent):

```
Specimen = Table[{Real, {-512, 511}}, {2}];
```

■ Running the algorithm

Format: **PSOAdvVmax**[*Cost function, Specimen, Iterations, Number of particles, c1 , c2, Vector of max. velocities*]

Result format: $\{gBest\ Value, \{gBest\ Position\}\}$

```
result = PSOAdvVmax[CF, Specimen, 100, 40, 2, 2, {51.15, 51.15}]
{-837.95, {420.649, 420.831}}
```

Getting gBest value only

```
result[[1]]
-837.95
```

Getting gBest positon only

```
result[[2]]
{420.649, 420.831}
```