

# 交易系统的泛属性状态编号机制与参数反馈优化闭环结构（代码）

- 作者：GaoZheng
- 日期：2025-03-19

```
(*---清空环境---*)
```

```
ClearAll[S, P, SamplePaths, ObservedValues, T, MicroDifferential,  
PathIntegralLogic, params, DeriOptimize, InferTopology,  
InferAlgebra, GcpolaaOptimizeDynamic, PredictEvolution];
```

```
(*---定义状态集合 S (中文) ---*)
```

```
S = {  
"账户健康", "账户压力", "账户极端", "价格上涨",  
"价格下跌", "价格剧烈波动", "策略盈利", "策略小亏",  
"策略大亏", "趋势确认", "趋势反转", "趋势震荡",  
"持仓增加", "持仓减少", "持仓锁仓", "波动率上升",  
"波动率下降", "波动率稳定"};
```

```
(*---定义属性集合 P (包括波动参数) ---*)
```

```
P = <|"账户健康" -> <|"净值" -> 1.0, "敞口" -> 0.2, "收益" -> 0.5, "波动" -> 0.1|>,  
"账户压力" -> <|"净值" -> -0.7, "敞口" -> 0.7, "收益" -> -0.3, "波动" -> 0.4|>,  
"账户极端" -> <|"净值" -> -1.0, "敞口" -> 1.0, "收益" -> -0.8, "波动" -> 0.6|>,  
"价格上涨" -> <|"净值" -> 0.3, "敞口" -> 0.1, "收益" -> 0.8, "波动" -> 0.2|>,  
"价格下跌" -> <|"净值" -> -0.3, "敞口" -> 0.1, "收益" -> -0.8, "波动" -> 0.2|>,  
"价格剧烈波动" -> <|"净值" -> 0.0, "敞口" -> 0.2, "收益" -> 0.0, "波动" -> 0.9|>,  
"策略盈利" -> <|"净值" -> 0.7, "敞口" -> 0.3, "收益" -> 0.9, "波动" -> 0.1|>,  
"策略小亏" -> <|"净值" -> -0.2, "敞口" -> 0.4, "收益" -> -0.3, "波动" -> 0.2|>,  
"策略大亏" -> <|"净值" -> -0.6, "敞口" -> 0.7, "收益" -> -0.7, "波动" -> 0.4|>,  
"趋势确认" -> <|"净值" -> 0.5, "敞口" -> 0.2, "收益" -> 0.7, "波动" -> 0.2|>,  
"趋势反转" -> <|"净值" -> -0.4, "敞口" -> 0.3, "收益" -> -0.6, "波动" -> 0.5|>,  
"趋势震荡" -> <|"净值" -> 0.1, "敞口" -> 0.1, "收益" -> 0.1, "波动" -> 0.6|>,  
"持仓增加" -> <|"净值" -> 0.2, "敞口" -> 0.9, "收益" -> 0.3, "波动" -> 0.3|>,  
"持仓减少" -> <|"净值" -> 0.1, "敞口" -> -0.8, "收益" -> 0.2, "波动" -> 0.2|>,  
"持仓锁仓" -> <|"净值" -> 0.0, "敞口" -> 0.0, "收益" -> 0.0, "波动" -> 0.1|>,  
"波动率上升" -> <|"净值" -> 0.0, "敞口" -> 0.4, "收益" -> 0.0, "波动" -> 1.0|>,  
"波动率下降" -> <|"净值" -> 0.0, "敞口" -> 0.2, "收益" -> 0.0, "波动" -> -1.0|>,  
"波动率稳定" -> <|"净值" -> 0.0, "敞口" -> 0.1, "收益" -> 0.0, "波动" -> 0.0|>|>;
```

```
(*---定义样本路径---*)
```

```
SamplePaths = {  
{ "账户健康", "价格上涨", "策略盈利", "趋势确认", "持仓增加" },  
{ "账户健康", "价格下跌", "策略小亏", "趋势震荡", "持仓减少" },  
{ "账户压力", "价格下跌", "策略大亏", "趋势反转", "持仓减少" },  
{ "账户极端", "价格剧烈波动", "策略大亏", "趋势反转", "波动率上升" },  
{ "账户压力", "价格上涨", "策略小亏", "趋势震荡", "波动率稳定" },
```

```
{ "账户健康", "价格上涨", "策略盈利", "趋势确认", "波动率下降" } };
```

```
(*---定义观测得分---*)
```

```
ObservedValues = {3.5, 1.0, -3.0, -4.0, 0.5, 4.0};
```

```
(*---定义微分动力学子 (包括波动参数) ---*)
```

```
MicroDifferential[s1_, s2_, {wM_, wC_, wE_, wV_}] :=  
Module[{dM, dC, dE, dV}, dM = P[s2][ "净值" ] - P[s1][ "净值" ];  
dC = P[s2][ "敞口" ] - P[s1][ "敞口" ];  
dE = P[s2][ "收益" ] - P[s1][ "收益" ];  
dV = P[s2][ "波动" ] - P[s1][ "波动" ];  
wM dM + wC dC + wE dE + wV dV];
```

```
(*---路径积分逻辑性度量---*)
```

```
PathIntegralLogic[path_, {wM_, wC_, wE_, wV_}] :=  
Total[Table[  
Tanh[MicroDifferential[path[[i]],  
path[[i + 1]], {wM, wC, wE, wV}]], {i, Length[path] - 1}]];
```

```
(*---参数优化 DeriOptimize---*)
```

```
DeriOptimize[paths_, obsVals_] :=  
Module[{loss, res},  
loss[{wM_, wC_, wE_, wV_}] :=  
Total[(Table[  
PathIntegralLogic[path, {wM, wC, wE, wV}], {path, paths}] -  
obsVals)^2];  
res =  
NMinimize[{loss[{wM, wC, wE, wV}], -2 <= wM <= 2 && -2 <= wC <=  
2 && -2 <= wE <= 2 && -2 <= wV <= 2}, {wM, wC, wE, wV}];  
{wM, wC, wE, wV} /. Last[res]];
```

```
(*---推导局部代数规则 InferAlgebra---*)
```

```
InferAlgebra[paths_, params_] :=  
Flatten[Table[  
MicroDifferential[path[[i]], path[[i + 1]], params] == 0, {path,  
paths}, {i, Length[path] - 1}]];
```

```
(*---推导拓扑结构 InferTopology---*)
```

```
InferTopology[paths_, params_] :=  
Module[{T0}, T0 = Association[Table[state -> {}, {state, S}]];
```

```

Do[Do[
  If[! MemberQ[T0[path[[i]]],
    path[[i + 1]] && (MicroDifferential[path[[i]],
      path[[i + 1]], params] >= -0.5),
    AppendTo[T0[path[[i]], path[[i + 1]]], {i,
      Length[path] - 1}], {path, paths}];
Association[
  KeyValueMap[#1 ->
    Select[#2, (Abs[MicroDifferential[#1, #, params]] <= 1.5) &] &,
    T0]]];

```

(\*---动态路径优化 GcpolaaOptimizeDynamic---\*)

```

GcpolaaOptimizeDynamic[init_, learningRate_ : 0.05] :=
Module[{current = init, path = {init}, totalScore = 0,
  initLocalParams = params, localParams = params, diff, step = 1},
Print["初始状态: ", current];
Print["初始参数 (params) : ", localParams];
While[T[current] != {},
  current =
    First@MaximalBy[T[current],
      Tanh[MicroDifferential[path[[-1]], #, localParams]] &];
  diff = MicroDifferential[path[[-1]], current, localParams];
  Print["第 ", step, " 步: 从 ", path[[-1]], " $$RightArrow ", current,
    ", 局部微分压强 = ", N[diff], ", 当前参数 = ", N[localParams]];
  localParams =
    localParams + learningRate*Sign[{diff, diff, diff, diff}];
  totalScore +=
    Tanh[MicroDifferential[path[[-1]], current, localParams]];
  AppendTo[path, current];
  step++;];
<|"Path" -> path, "FinalParams" -> localParams,
  "InitLocalParams" -> initLocalParams, "Score" -> totalScore|>];

```

(\*---预测未来路径 PredictEvolution---\*)

```

PredictEvolution[init_, stepsMax_ : 10, learningRate_ : 0.05,
  threshold_ : 0.3] :=
Module[{current = init, path = {init}, totalScore = 0,
  initLocalParams = params, localParams = params, diff, step = 1,
  stop = False}, Print["初始状态: ", current];
Print["初始参数 (params) : ", localParams];

```

```

While[! stop && step <= stepsMax && T[current] != {},
  current =
    First@MaximalBy[T[current],
      Tanh[MicroDifferential[path[[-1]], #, localParams]] &];
diff = MicroDifferential[path[[-1]], current, localParams];
Print["第 ", step, " 步: 从 ", path[[-1]], " $$RightArrow ", current,
  ", 局部微分压强 = ", N[diff], ", 当前参数 = ", N[localParams]];
localParams =
  localParams + learningRate*Sign[{diff, diff, diff, diff}];
totalScore +=
  Tanh[MicroDifferential[path[[-1]], current, localParams]];
AppendTo[path, current];
If[Abs[diff] < threshold, Print["逻辑性塌缩或路径分岔检测: 局部微分压强太小, 停止演化"];
  stop = True;];
step++;];
<|"PredictedPath" -> path, "FinalParams" -> localParams,
  "InitLocalParams" -> initLocalParams, "TotalScore" -> totalScore|>];

```

(\*---执行完整流程---\*)

```

params = DeriOptimize[SamplePaths, ObservedValues];
algebraConstraints = InferAlgebra[SamplePaths, params];
T = InferTopology[SamplePaths, params];
optimizedResult = GcpolaaOptimizeDynamic["账户健康"];
predictedResult = PredictEvolution["账户压力"];

```

(\*---最终输出---\*)

```

Print@Dataset[<|"优化后的参数params" -> params,
  "推导的局部代数规则" -> Dataset@algebraConstraints, "推导的拓扑结构" -> Dataset@T,
  "最优路径与得分" -> optimizedResult, "预测路径参数与得分" -> predictedResult|>];

```

初始状态：账户健康

初始参数 (params) : {-2.,2.,0.189653,-2.}

第 1 步：从 账户健康  $\$RightArrow$  价格下跌,  
局部微分压强 = 1.95345, 当前参数 = {-2.,2.,0.189653,-2.}

第 2 步：从 价格下跌  $\$RightArrow$  策略大亏,  
局部微分压强 = 1.44897, 当前参数 = {-1.95,2.05,0.239653,-1.95}

初始状态：账户压力

初始参数 (params) : {-2.,2.,0.189653,-2.}

<| 优化后的参数params->{-2.,2.,0.189653,-2.},  
推导的局部代数规则->  
{False,False,False,False,False,False,False,False,  
False,False,False,False,False,False,False,False,  
False,False,False,False,False,False},  
推导的拓扑结构->  
<| 账户健康->{价格上涨,价格下跌},  
账户压力->{},账户极端->{},价格上涨->{策略盈利,策略小亏},  
价格下跌->{策略小亏,策略大亏},价格剧烈波动->{策略大亏},  
策略盈利->{趋势确认},策略小亏->{},策略大亏->{},  
趋势确认->{持仓增加,波动率下降},趋势反转->{},  
趋势震荡->{波动率稳定},持仓增加->{},持仓减少->{},  
持仓锁仓->{},波动率上升->{},波动率下降->{},波动率稳定->{}|>,  
最优路径与得分-><|  
Path->{账户健康,价格下跌,策略大亏},  
FinalParams->{-1.9,2.1,0.289653,-1.9},  
InitLocalParams->{-2.,2.,0.189653,-2.},  
Score->1.85046|>,  
预测路径参数与得分-><|  
PredictedPath->{账户压力},  
FinalParams->{-2.,2.,0.189653,-2.},  
InitLocalParams->{-2.,2.,0.189653,-2.},  
TotalScore->0|>|>

## 许可声明 (License)

Copyright (C) 2025 GaoZheng

本文档采用[知识共享-署名-非商业性使用-禁止演绎 4.0 国际许可协议 \(CC BY-NC-ND 4.0\)](#)进行许可。