SwarmsLAB

Evolution with the world

SxLAB Family Member

SwarmFish

-- The Artificial Fish Swarm Algorithm (AFSA)

Ver. 1003

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07-Jun-2013

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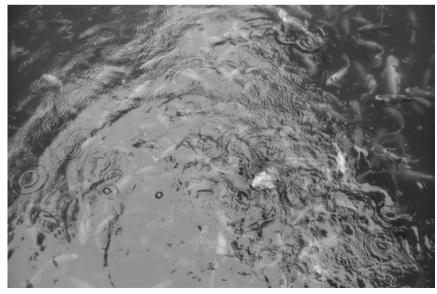
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Artificial Fish Swarm Algorithm (AFSA)

The artificial fish swarm algorithm (AFSA) was first proposed in 2002, inspired by the social behaviours of the fish school in searching, swarming and following. A schooling fish can take quickly response to the changes in the direction and speed of their neighbours, information of their behaviours have been passing to others which help them moving from one configuration to another almost as one unit. By borrowing this intelligence of the social behaviours, the AFSA is parallel, independent to the initial values and able to achieve a global optimum.
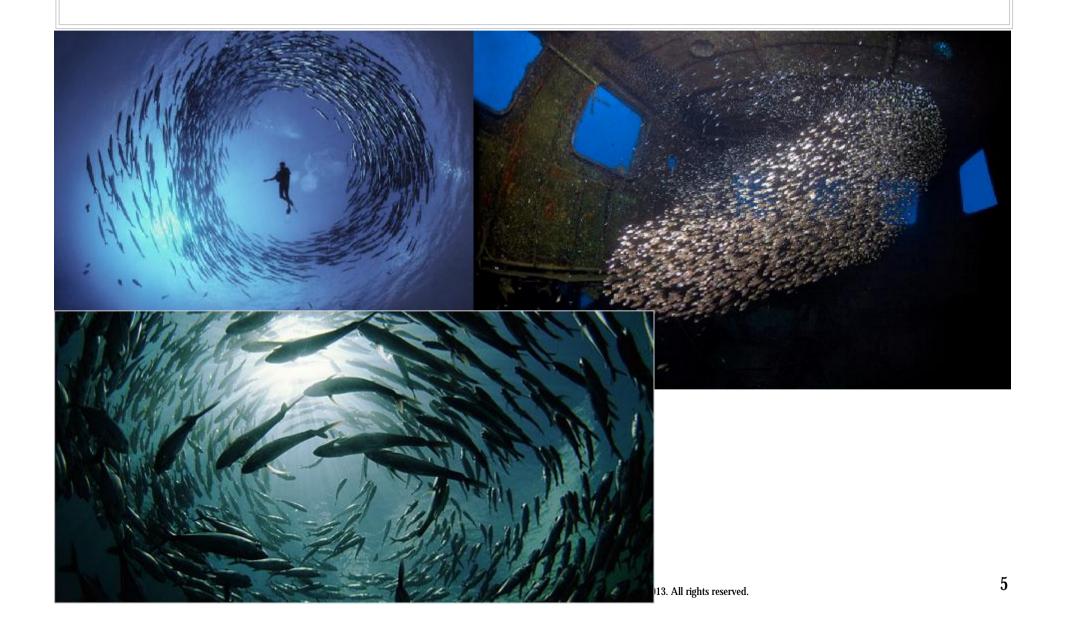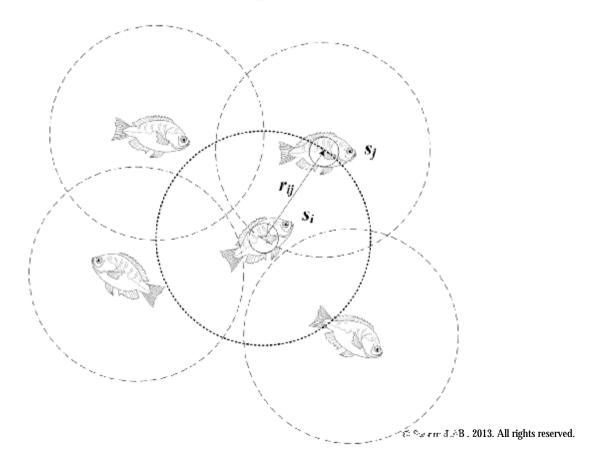
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Artificial Fish Swarm Algorithm (AFSA)

Artificial Fish Swarm Algorithm (AFSA)

the AFSA includes five steps of operations: (1) **behaviour selection**, (2) **searching behaviour**, (3) **swarming behaviour**, (4) **following behaviour** and (5) **bulletin**. A `max-generation' is the trial number of an AF school searching for food under given initial conditions, which is one of the widely used criteria for the simulation termination.

Reference

[1] X.L. Li, Z.J. Shao, J.X. Qian, ``An optimizing method based on autonomous animate: fish swarm algorithm", System Engineering Theory and Practice, vol. 22, no. 11, pp. 32-38 (2002)

[2] Chen, Yi; Zhang, Guangfeng; Li, Yiyang; Ding, Yi; Zheng, Bin; Miao, Qiang. 2013. "Quantitative Analysis of Dynamic Behaviours of Rural Areas at Provincial Level Using Public Data of Gross Domestic Product ." *Entropy* 15, no. 1: 10-31.
http://www.mdpi.com/1099-4300/15/1/10

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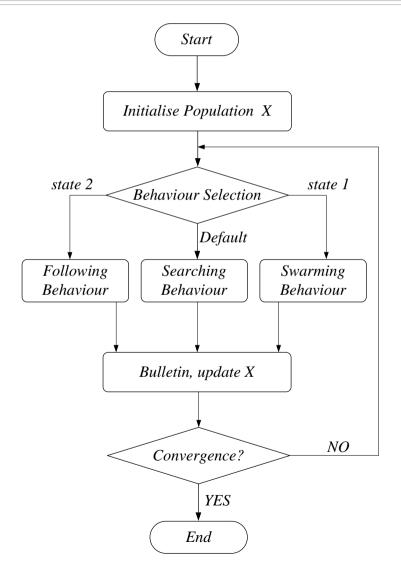
Workflow of simple AFSA


```
Begin (1)

    t = 0 ;
    Initialise X(0);

      While ( Not termination-condition) do

        Begin (2)
       {
         t = t + 1;

         Switch( Evaluation X(t) )
       {
           state 1: swarming behaviour;
           state 2: following behaviour;
           default: searching behaviour;
       }

         bulletin X(t);
          }

        End (2)

End (1)
```
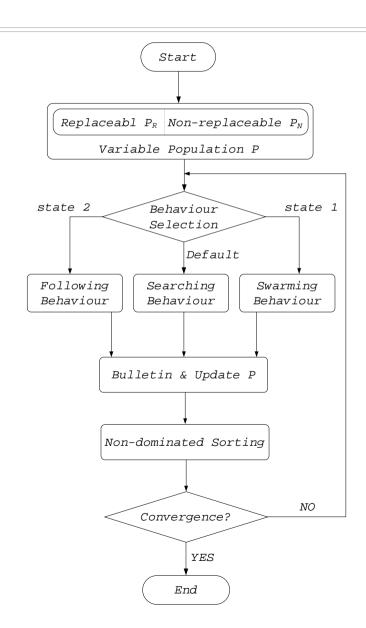
Flowchart labels: Start, Initialise Population X, Behaviour Selection, state 2, state 1, Default, Following Behaviour, Searching Behaviour, Swarming Behaviour, Bulletin, update X, Convergence?, NO, YES, End

Contents

Workflow of multi-objective AFSA


```
Begin (1)

  t = 0 ;
  Initialise P(0);

    While ( Not termination-condition) do

      Begin (2)
    {
      t    = t + 1;
      flag = Evaluation P(t);

      switch( Behaviour Selection( flag ) )
    {
       state 1: swarming behaviour;
       state 2: following behaviour;
       default: searching behaviour;
      }

      bulletin P(t)= P_R + P_N;

    % Non-dominated Sorting
       Step 1: Fast non-dominated sort
       Step 2: crowding distance assignment
       Step 3: crowded-comparison operator
        }

      End (2)

End (1)
```

Flowchart:
- Start
- Replaceabl P_R | Non-replaceable P_N — Variable Population P
- Behaviour Selection (state 2, state 1, Default)
- Following Behaviour, Searching Behaviour, Swarming Behaviour
- Bulletin & Update P
- Non-dominated Sorting
- Convergence? — NO / YES
- End

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How to download SwarmFish

1. Search "SwarmFish" in **file exchange @ mathwork.com**

SwarmFish - The Artificial Fish Swarm Algorithm
http://www.mathworks.com/matlabcentral/fileexchange/32022

2. Search "SwarmFish" via Google or skydrive
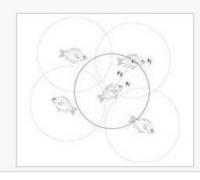
SwarmFish1002
http://sdrv.ms/ZyoDVb

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by Yi Chen

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SwarmFish - The Artificial Fish Swarm Algorithm
Simulation Tool

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Highlights from
SwarmFish - The Artificial Fish Swarm Algorithm

fx SGA_FITNESS_function(x,y)
/*M-FILE FUNCTION
SGA_FITNESS_function MMM
SGALAB */ %

📄 SwarmFish_demo_SO_std.m

View all files

File Information

Description   the AFSA includes five steps of operations: (1) behaviour selection, (2) searching behaviour, (3) swarming behaviour, (4) following behaviour and (5) bulletin. A `max-generation' is the trial number of an AF school searching for food under given initial conditions, which is one of the widely used criteria for the simulation termination.

Acknowledgements   The author wishes to acknowledge the following in the creation of this submission:
SGALAB 1003 Beta 5.0.0.8(Matrix Varaible Inputs)

Required Products   Communications System Toolbox

MATLAB release   MATLAB 7.10 (2010a)

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swarmfish

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→ **How to set work path for SwarmFish**

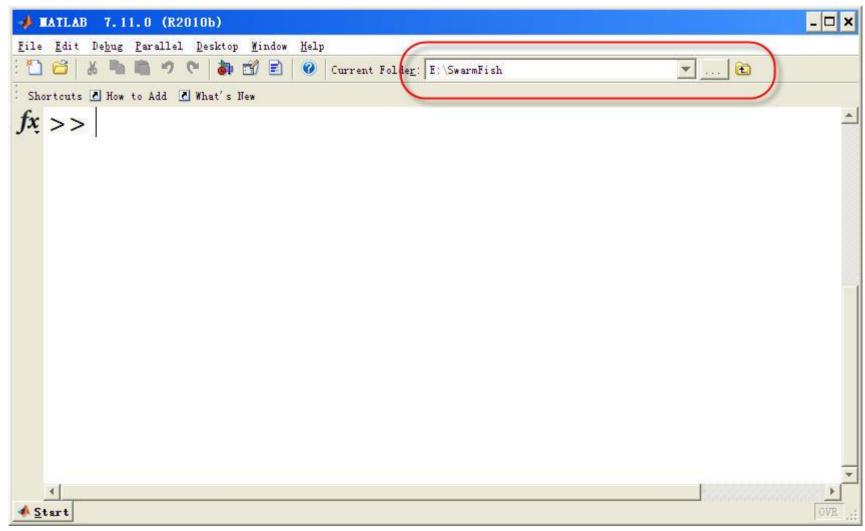Case Studies

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Set SwarmFish work path

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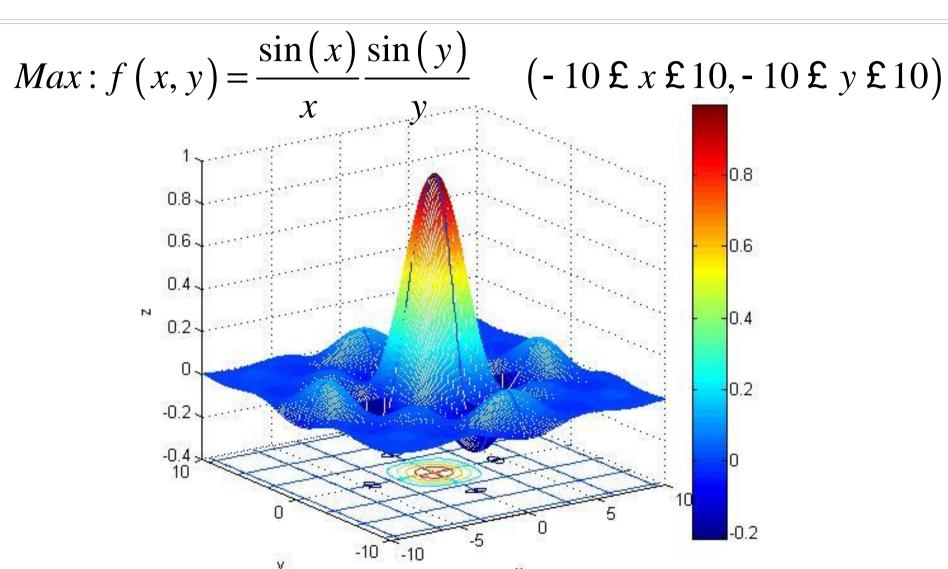How to set work path for SwarmFish

Case Studies

FAQ

Case Study 1 – Single Objective Without Constraints

$$Max: f(x, y) = \frac{\sin(x)}{x}\frac{\sin(y)}{y} \qquad (-10 \leq x \leq 10, -10 \leq y \leq 10)$$

Case Study 1 – Single Objective Without Constraints

$$Max: f(x, y) = \frac{\sin(x)}{x} \frac{\sin(y)}{y} \qquad (-10 \le x \le 10, -10 \le y \le 10)$$

SGA_FITNESS_function.m

```
function [ fitness ] = SGA_FITNESS_function( x, y )

%SGA_FITNESS_function begin
%User can design their own fitness function here
%as a standard matlab function

  fitness = (sin(x)./(x+eps)).*(sin(y)./(y+eps));

%SGA_FITNESS_function end
```
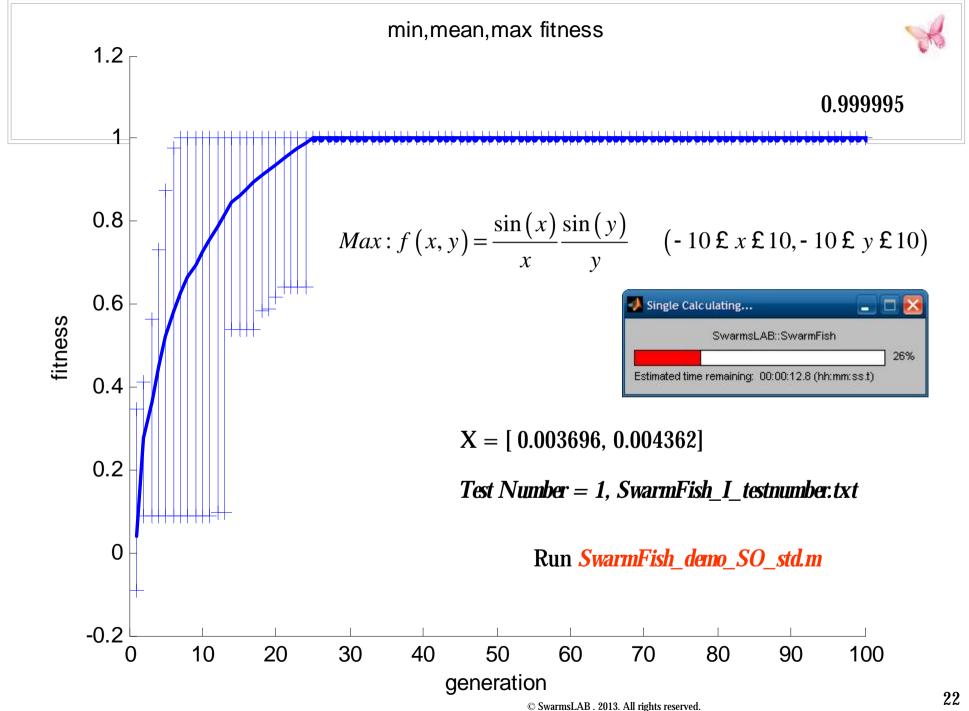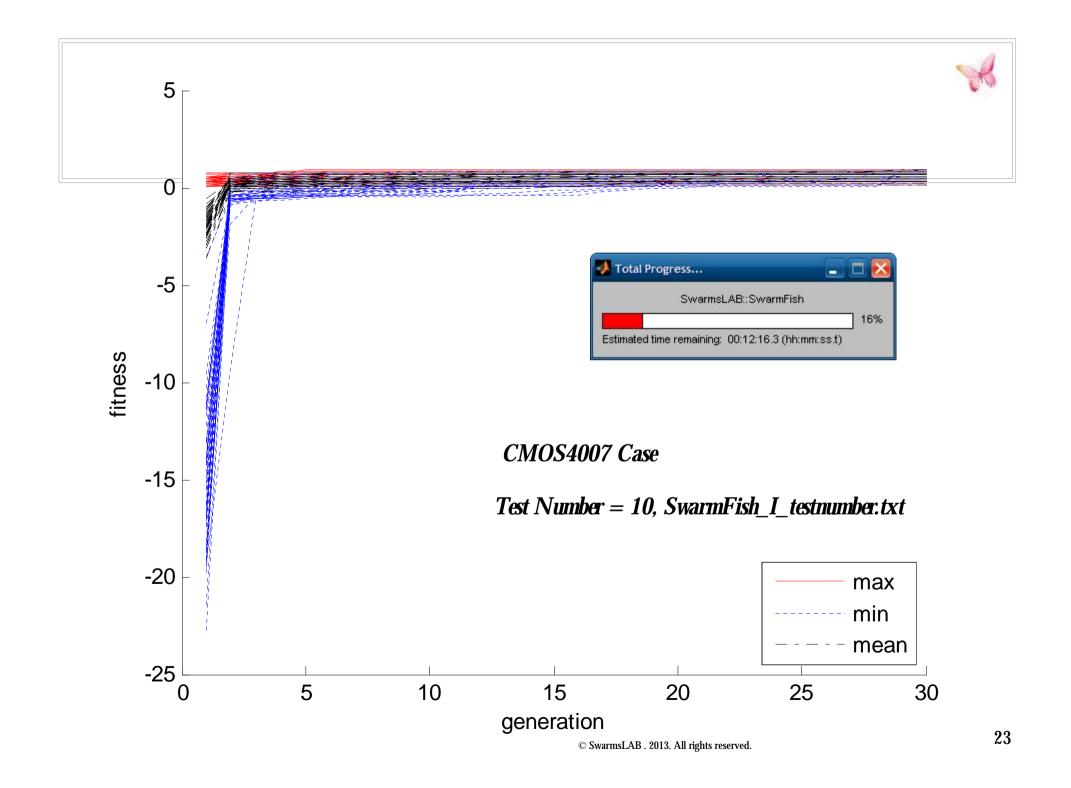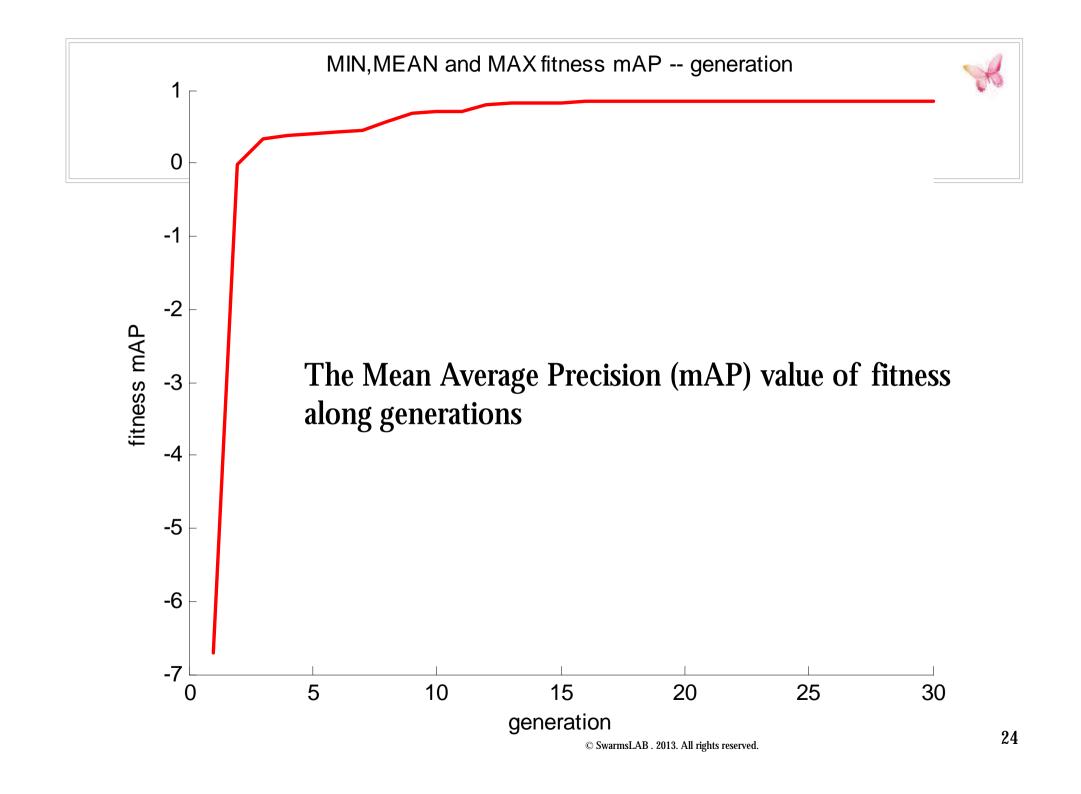
Set parameters – **I**nput files (*SwarmFish_I_**)

Parameters	Value	file
Max Generation	*100*	*SwarmFish_I_max_generation.txt*
Crowd Factor	*0.618*	*SwarmFish_I_crowd.txt*
Population	*30*	*SwarmFish_I_population.txt*
Step	*0.01*	*SwarmFish_I_steps.txt*
Visual Factor	*2.5*	*SwarmFish_I_visual.txt*
Max Confines	*10* *10*	*SwarmFish_I_max_confines.txt*
Min Confines	*-10* *-10*	*SwarmFish_I_min_confines.txt*
Test Number	*10*	*SwarmFish_I_testnumber.txt*
Searching Try Number	*5*	*SwarmFish_I_try_number.txt*

min,mean,max fitness

0.999995

$$Max : f(x, y) = \frac{\sin(x)}{x} \frac{\sin(y)}{y} \qquad (-10 \pounds x \pounds 10, -10 \pounds y \pounds 10)$$

Single Calculating...

SwarmsLAB::SwarmFish

26%

Estimated time remaining: 00:00:12.8 (hh:mm:ss.t)

X = [0.003696, 0.004362]

Test Number = 1, SwarmFish_I_testnumber.txt

Run *SwarmFish_demo_SO_std.m*

fitness

generation

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CMOS4007 Case

Test Number = 10, SwarmFish_I_testnumber.txt

max
min
mean

MIN, MEAN and MAX fitness mAP -- generation

fitness mAP vs generation, with axes ranging from 0 to 30 on generation and -7 to 1 on fitness mAP.

The Mean Average Precision (mAP) value of fitness along generations

Solve and results – **O**utput files (*SwarmFish_O_**)

Results in 'SwarmFish_O_*.txt' $\longrightarrow$ Single Objective Problem **ONLY**

Results	Value	File
$F(x_0)\big|_{max}$	0.9909	SwarmFish_O_maxfitness.txt
$F(x_0)\big|_{min}$	0.060569	SwarmFish_O_minfitness.txt
$F(x_0)\big|_{mean}$	0.934436	SwarmFish_O_meanfitness.txt
x_0	0.003696, 0.004362	SwarmFish_O_best_result_space.txt
Cost time (sec.)	1.2350	In command window

Multi-objective Problem check '*SwarmFish_O_*MO*.mat'
To plot the Pareto Front see **FAQ 8 in SGALAB_FAQ_QuickStart_1.pdf**

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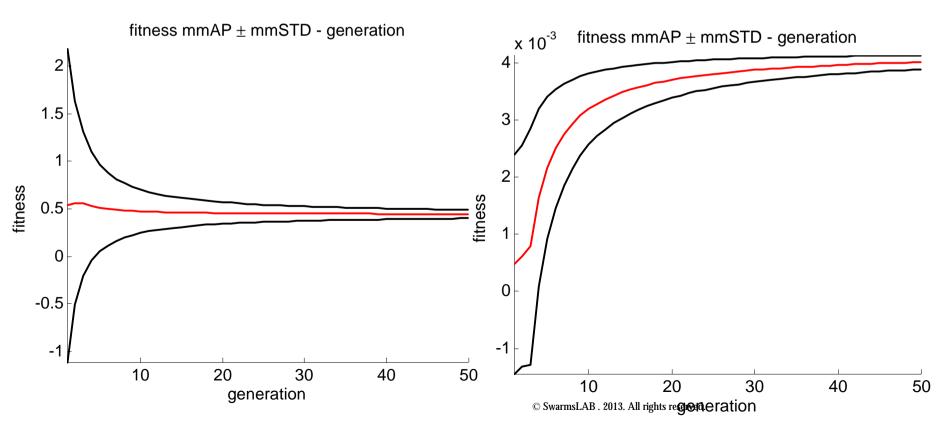
Workflow of multi-objective AFSA

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Case Studies

$\longrightarrow$ **FAQ**

Case Study 3 – Two Objectives

fitness mmAP ± mmSTD - generation

fitness mmAP ± mmSTD - generation

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FAQ

1. Can handle single objective problems?
   YES

2. Can handle multi-objective problems ?
   YES

3. Where can I find .p files?

http://sdrv.ms/10Nvnzi

FAQ

4. How to cite this toolbox?

\bibitem{SwarmFish2013}
Y. Chen,
SwarmFish - The Artificial Fish Swarm Algorithm,
http://www.mathworks.com/matlabcentral/fileexchange/32022
(2013)

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END

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Ver. 1003

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07-Jun-2013

[八声甘州.清秋怀古]#

遍古今长江水东流，千年风雨稠。
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谁如烟，渺渺诗笺，明月正圆。

*10-Sep-2009