Golodko Lab-3

Source Code

GA.cs

```
using System;
using System.Collections.Generic;
using System.Linq;
using System.Text;
using System.Threading;
using System.Threading.Tasks;

namespace lab3_siit_golodko
{
    class GA
    {
        Random random;
        List<Population> historyOfPopulation;
        public GA()
        {
            random = new Random();
            List<Net> Nets = new List<Net>();
            for(int i=0;i<100;i++)
            {
                List<List<double>> w1 = new
List<List<double>>();
                 List<double> w2 = new List<double>();
                for(int j=0;j<5;j++)
                {
                    w2.Add(2 * random.NextDouble() - 1);
                    List<double> tempW1 = new List<double>();
                    for (int t = 0; t < 5; t++)
                        tempW1.Add(2 * random.NextDouble() - 1);
                    w1.Add(tempW1);
```

```
                }
                Nets.Add(new Net(w1,w2));
            }
            Population startPopulation = new Population(Nets);
            historyOfPopulation = new List<Population>();
            historyOfPopulation.Add(startPopulation);
            int k = 0;
            while(historyOfPopulation[k].theBestFitness!=32)
            {
                Thread.Sleep(10);

historyOfPopulation.Add(getNextPupulation(historyOfPopulation[k]
));
                k++;
            }
        }
        private List<Net> population;
        private Population getNextPupulation(Population
parentPopulation)
        {
            List<Net> childrenPopulationNets = new List<Net>();

            for (int i=0;i<50;i++)
            {
                List<Net> childrenNets = getChildren(
                    parentPopulation.Nets[random.Next() %
50+50],
                    parentPopulation.Nets[random.Next() % 50+50]
                    );
                childrenPopulationNets.AddRange(childrenNets);
            }
            for (int k = 0; k < childrenPopulationNets.Count;
k++)
```

```
            {
                for (int i = 0; i <
childrenPopulationNets[k].w1.Count; i++)
                {
                    for (int j = 0; j <
childrenPopulationNets[k].w1[i].Count; j++)
                    {
                        int prob = random.Next(0, 1000);
                        if (prob == 777)
                        {
                            childrenPopulationNets[k].w1[i][j] =
2*random.NextDouble()+ 1;
                        }
                    }
                }
                for (int j = 0; j <
childrenPopulationNets[k].w2.Count; j++)
                {
                    int prob = random.Next(0, 1000);
                    if (prob == 777)
                    {
                        childrenPopulationNets[k].w2[j] = 2 *
random.NextDouble() + 1;
                    }
                }
            }
            //Sorting by fitness
            for (int i = 0; i < childrenPopulationNets.Count;
i++)
            {
                for (int j = childrenPopulationNets.Count - 1; j
> i; j--)
                {
                    if (childrenPopulationNets[j].fitness <
childrenPopulationNets[j - 1].fitness)
```

```
                    {
                        Net tempNet = childrenPopulationNets[j];
                        childrenPopulationNets[j] =
childrenPopulationNets[j - 1];
                        childrenPopulationNets[j - 1] = tempNet;
                    }
                }
            }
            Population childrenPopulation = new
Population(childrenPopulationNets);
            return childrenPopulation;
        }
        Boolean isReady(List<Population> historyOfPopulation)
        {
            if (historyOfPopulation[historyOfPopulation.Count -
1].theBestFitness == 32)
                return true;
            else
                return false;
            //if (historyOfPopulation.Count < 100)
            //    return false;
            //else
            //{
            //    for (int i = historyOfPopulation.Count - 100;
i < historyOfPopulation.Count; i++)
            //    {
            //        if
(historyOfPopulation[historyOfPopulation.Count -
100].avarageFitness != historyOfPopulation[i].avarageFitness)
            //            return false;
            //    }
            //    return true;
            //}
        }
```

```
        private List<Net> getChildren(Net father,Net mother)
        {
            List<Net> childrenNets = new List<Net>();
                Random random = new Random();
                List<Boolean> mask = new List<bool>();
            List<List<double>> firstW1 = new
List<List<double>>();
            List<List<double>> secondW1 = new
List<List<double>>();
            List<double> firstW2 = new List<double>();
            List<double> secondW2 = new List<double>();
            for(int i=0;i<father.w1.Count;i++)
            {
                for(int j=0;j< father.w1[i].Count;j++)
                {
                    List<double> firstTempW1 = new
List<double>();
                    List<double> secondTempW1 = new
List<double>();
                    if (random.Next() % 2 == 0)
                    {
                        firstTempW1.Add(father.w1[i][j]);
                        secondTempW1.Add(mother.w1[i][j]);
                    }
                    else
                    {
                        firstTempW1.Add(mother.w1[i][j]);
                        secondTempW1.Add(father.w1[i][j]);
                    }
                    father.w1.Add(firstTempW1);
                    mother.w1.Add(secondTempW1);
                }
            }
```

```
            for (int j = 0; j < father.w2.Count; j++)
            {
                if (random.Next() % 2 == 0)
                {
                    firstW2.Add(father.w2[j]);
                    secondW2.Add(mother.w2[j]);
                }
                else
                {
                    firstW2.Add(mother.w2[j]);
                    secondW2.Add(father.w2[j]);
                }
            }
                childrenNets.Add(new Net(firstW1,firstW2));
                childrenNets.Add(new Net(secondW1,secondW2));
            return childrenNets;
        }
    }
}
```

Net.cs

```
using System;
using System.Collections.Generic;
using System.Linq;
using System.Text;
using System.Threading.Tasks;

namespace lab3_siit_golodko
{
    class Net
```

```
{
    public List<double> etalonInput2;
    public List<double> etalonResult2;
    public List<List<double>> w1;
    public List<double> w2;
    public int fitness;
    double[,] etalonInput = new double[,]
    {
    {-1, -1, -1, -1, -1 },
    {-1, -1, -1, -1, 1},
    {-1, -1, -1, 1,  -1},
    {-1, -1, -1, 1,  1},
    {-1, -1, 1,  -1, -1},
    {-1, -1, 1,  -1, 1},
    {-1, -1, 1,  1,  -1},
    {-1, -1, 1,  1,  1},
    {-1, 1,  -1, -1, -1},
    {-1, 1,  -1, -1, 1},
    {-1, 1,  -1, 1,  -1},
    {-1, 1,  -1, 1,  1},
    {-1, 1,  1,  -1, -1},
    {-1, 1,  1,  -1, 1},
    {-1, 1,  1,  1,  -1},
    {-1, 1,  1,  1,  1},
    {1, -1, -1, -1, -1},
    {1, -1, -1, -1, 1},
    {1, -1, -1, 1,  -1},
    {1, -1, -1, 1,  1},
    {1, -1, 1,  -1, -1},
    {1, -1, 1,  -1, 1},
    {1, -1, 1,  1,  -1},
    {1, -1, 1,  1,  1},
```

```
        {1, 1,  -1, -1, -1},
        {1, 1,  -1, -1, 1},
        {1, 1,  -1, 1,  -1},
        {1, 1,  -1, 1,  1},
        {1, 1,  1,  -1, -1},
        {1, 1,  1,  -1, 1},
        {1, 1,  1,  1,  -1},
        {1, 1,  1,  1,  1}};
        double[] etalonResult = new double[]
        {1, 0, 0, 1, 0, 1, 1, 0, 0, 1, 1, 0, 1, 0, 0, 1, 0, 1,
1, 0, 1, 0, 0, 1, 1, 0, 0, 1, 0, 1, 1, 0};
        public Net(List<List<double>> w1,List<double> w2)
        {
            this.w1 = w1;
            this.w2 = w2;
            fitness = getFitness(w1,w2);
        }
        private int getFitness(List<List<double>> w1,
List<double> w2)
        {
            int count = 0;
            for (int k = 0; k < 32; k++)
            {
                List<double> tempLayout = new List<double>();
                for (int i = 0; i < w1.Count; i++)
                {
                    double tempWeight = 0;
                    for (int j = 0; j < 5; j++)
                    {
                        tempWeight += etalonInput[k,i]*
w1[i][j];
                    }
                    tempLayout.Add(tempWeight);
```

```
                }
                double final = 0;
                for(int i=0;i<tempLayout.Count;i++)
                {
                    final += tempLayout[i] * w2[i];
                }
                double afterActivation;
                if (final > 0)
                    afterActivation= 1;
                else
                    afterActivation= - 1;
                if (afterActivation == etalonResult[k])
                    count++;
            }
            return count;
        }
    }
}
```

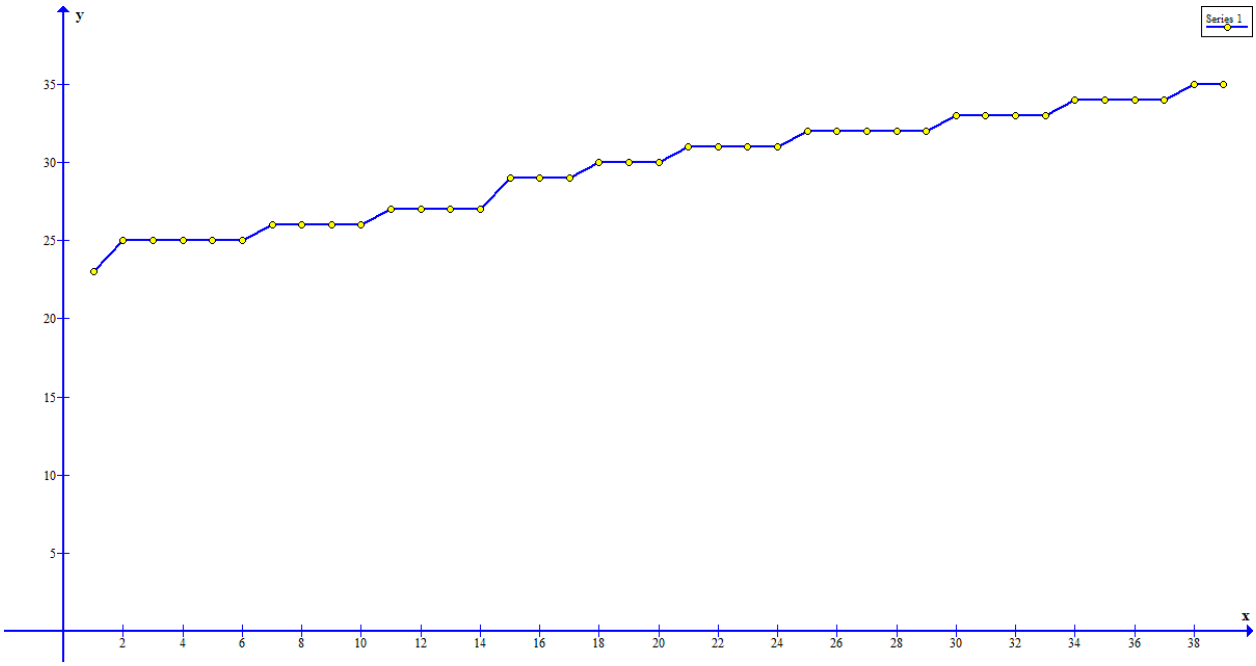
Population.cs

```
using System;
using System.Collections.Generic;
using System.Linq;
using System.Text;
using System.Threading.Tasks;

namespace lab3_siit_golodko
{
    class Population
    {
```

```
        public List<Net> Nets;
        public int theBestFitness;
        public int avarageFitness;
        public Population(List<Net> Nets)
        {
            this.Nets = Nets;
            theBestFitness = getTheBestFitness(Nets);
            avarageFitness = getAvarageFitness(Nets);
        }
        public int getTheBestFitness(List<Net> Nets)
        {
            int bestFitness = 0;
            for (int i = 0; i < Nets.Count; i++)
                if (bestFitness < Nets[i].fitness)
                    bestFitness = Nets[i].fitness;
            return bestFitness;
        }
        public int getAvarageFitness(List<Net> Nets)
        {
            int avarageFitness = 0;
            for (int i = 0; i < Nets.Count; i++)
                avarageFitness += Nets[i].fitness;
            avarageFitness /= Nets.Count;
            return avarageFitness;
        }
    }
}
```

Graphic



Etalon

-1	-1	-1	-1	-1	1
-1	-1	-1	-1	1	-1
-1	-1	-1	1	-1	-1
-1	-1	-1	1	1	1
-1	-1	1	-1	-1	-1
-1	-1	1	-1	1	1
-1	-1	1	1	-1	1
-1	-1	1	1	1	-1
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-1	1	-1	1	1	-1
-1	1	1	-1	-1	1
-1	1	1	-1	1	-1
-1	1	1	1	-1	-1
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1	-1	-1	-1	1	1
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1	1	-1	-1	1	-1

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1	1	-1	1	1	1
1	1	1	-1	-1	-1
1	1	1	-1	1	1
1	1	1	1	-1	1
1	1	1	1	1	-1

1)

Point 1

Fitness-20

-1	-1	-1	-1	-1	1	1
-1	-1	-1	-1	1	1	-1
-1	-1	-1	1	-1	1	-1
-1	-1	-1	1	1	-1	1
-1	-1	1	-1	-1	-1	-1
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-1	1	1	-1	1	-1	-1
-1	1	1	1	-1	1	-1
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1	-1	-1	-1	-1	1	-1
1	-1	-1	-1	1	1	1
1	-1	-1	1	-1	-1	1
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1	1	-1	1	1	1	1
1	1	1	-1	-1	-1	-1
1	1	1	-1	1	-1	1
1	1	1	1	-1	1	1

1	1	1	1	1	-1	-1

2)
point 8 fitness 22

-1	-1	-1	-1	-1	1
-1	-1	-1	-1	1	1
-1	-1	-1	1	-1	1
-1	-1	-1	1	1	-1
-1	-1	1	-1	-1	-1
-1	-1	1	-1	1	1
-1	-1	1	1	-1	-1
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-1	1	-1	1	1	-1
-1	1	1	-1	-1	-1
-1	1	1	-1	1	-1
-1	1	1	1	-1	1
-1	1	1	1	1	1
1	-1	-1	-1	-1	1
1	-1	-1	-1	1	1
1	-1	-1	1	-1	-1
1	-1	-1	1	1	-1
1	-1	1	-1	-1	-1
1	-1	1	-1	1	-1
1	-1	1	1	-1	-1
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1	1	-1	-1	-1	1
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1	1	-1	1	-1	-1
1	1	-1	1	1	1
1	1	1	-1	-1	-1
1	1	1	-1	1	1
1	1	1	1	-1	1
1	1	1	1	1	-1

3)
point 17, fitness-26

-1	-1	-1	-1	-1	1
-1	-1	-1	-1	1	-1

-1	-1	-1	1	-1	-1
-1	-1	-1	1	1	-1
-1	-1	1	-1	-1	-1
-1	-1	1	-1	1	1
-1	-1	1	1	-1	-1
-1	-1	1	1	1	-1
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-1	1	-1	1	1	-1
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1	1	-1	-1	-1	1
1	1	-1	-1	1	-1
1	1	-1	1	-1	-1
1	1	-1	1	1	1
1	1	1	-1	-1	-1
1	1	1	-1	1	1
1	1	1	1	-1	1
1	1	1	1	1	-1

4)

Point 25. Fitness 28

-1	-1	-1	-1	-1	1
-1	-1	-1	-1	1	-1
-1	-1	-1	1	-1	-1
-1	-1	-1	1	1	-1
-1	-1	1	-1	-1	-1
-1	-1	1	-1	1	1
-1	-1	1	1	-1	-1
-1	-1	1	1	1	-1
-1	1	-1	-1	-1	-1

-1	1	-1	-1	1	1
-1	1	-1	1	-1	-1
-1	1	-1	1	1	-1
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1	1	-1	1	1	1
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1	1	1	-1	1	1
1	1	1	1	-1	1
1	1	1	1	1	-1

5) point 38, fitness 32

-1	-1	-1	-1	-1	1
-1	-1	-1	-1	1	-1
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-1	-1	-1	1	1	1
-1	-1	1	-1	-1	-1
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-1	1	-1	1	1	-1
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1	-1	-1	-1	-1	-1

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1	-1	-1	1	-1	1
1	-1	-1	1	1	-1
1	-1	1	-1	-1	1
1	-1	1	-1	1	-1
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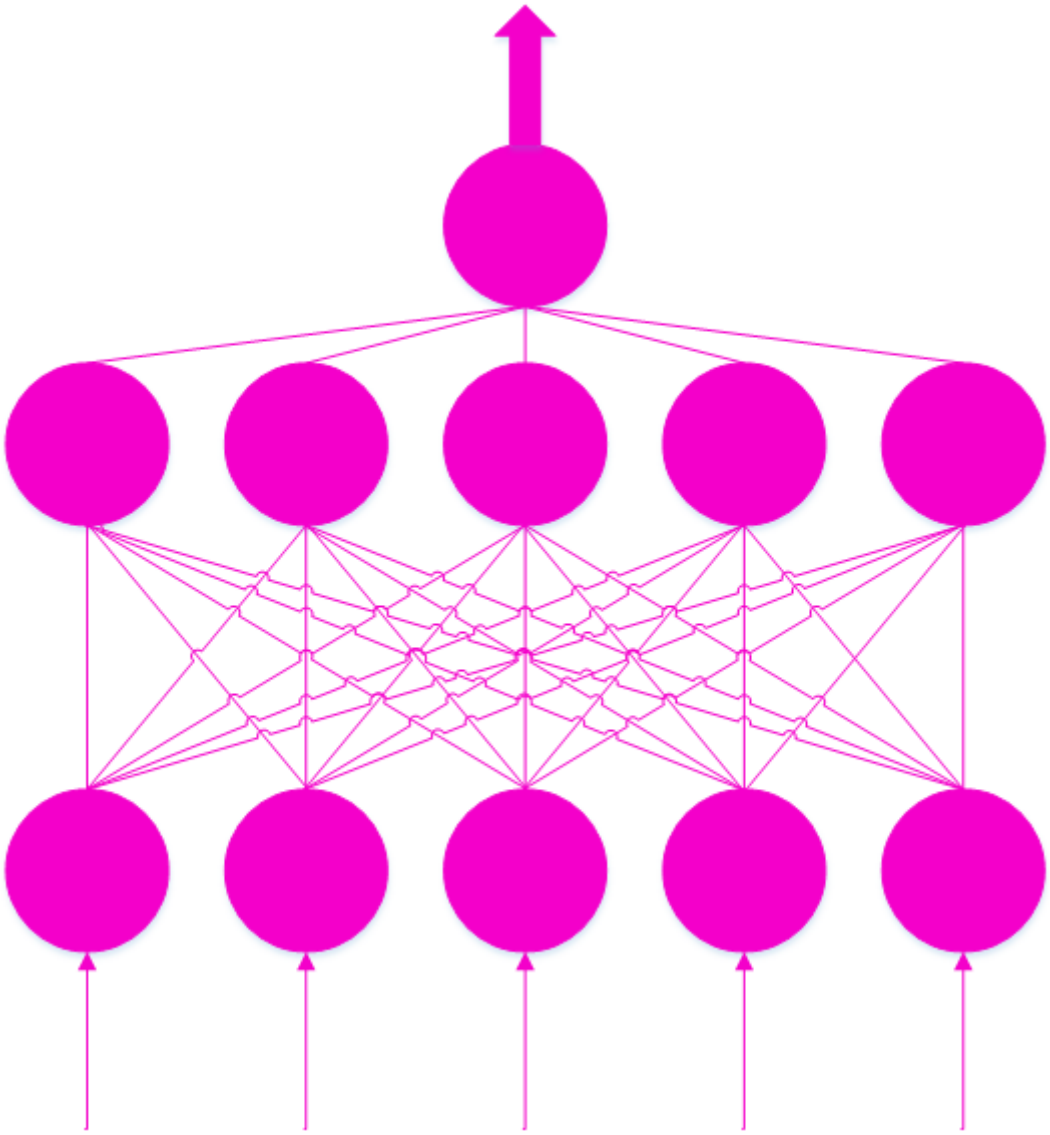
1	1	-1	1	-1	-1
1	1	-1	1	1	1
1	1	1	-1	-1	-1
1	1	1	-1	1	1
1	1	1	1	-1	1
1	1	1	1	1	-1

Neural Network



Weights

weight	value
w1	0,6234
w2	0,823
w3	0,523
w4	0,89
w5	-0,78
w6	0,345
w7	0,696
w8	0,759
w9	0,897
w10	0,54
w11	0,578
w12	0,345
w13	-0,45
w14	-0,509

w15	**0,678**
w16	**0,701**
w17	**0,768**
w18	**0,456**
w19	**-0,298**
w20	**0,897**
w21	**0,765**
w22	**-0,298**
w23	**-0,643**
w24	**-0,256**
w25	**0,345**
w26	**0,504**
w27	**-0,4245**
w28	**-0,7896**
w29	**0,8754**
w30	**0,3985**