FUZZY SYSTEM PROJECT REPORT

Habibollah Naeimi (SN.:9663124)

Lecturer: Dr. Shahbazian

Petroleum University of Technology

Ahwaz Faculty of Petroleum

Gradient Descent Training Algorithm

Fuzzy Systems Course

Lecturer: Dr.Shahbazian

Designing Fuzzy System using Gradient Descent Training Report

Habibollah Naeimi

In the Gradient Descent Training method, the structure of our system must be clear. This system is built on these assumptions: PIE, Singleton fuzzifier, Center of Average defuzzifier, and Gaussian Membership Function. Next, we update the relevant parameters using this method, which are y^l , x_i^l , and σ_i^l.

First, we initialize the parameters using on-line initial parameter choosing.

```
x_Bar = Pairs(1:M,1:InpuNum);
y_Bar = Pairs(1:M,end);
Sigma = repmat(((max(x_Bar)-min(x_Bar))/M),M,1);
```

Then we start training the algorithm with this code.

```
for p=1:size(Pairs,1)
     for l=1:M                          % Calculating z.
         for i=1:InpuNum
             iN_z(i) = exp(-(((Pairs(p,i)-
x_Bar(l,i))/Sigma(l,i))^2));
         end
```

```
        z(l) = prod(iN_z);
    end
    b = sum(z);                    % Calculating b.
    a = sum(y_Bar.*z);             % Calculating a.
    f = a/b;                       % Calculating f.
            for q=1:Q
                for l=1:M
                    y_Bar(l) = y_Bar(l)-Alpha*
(f-Pairs(p,end))/b*z(l);
                    for i=1:InpuNum
                        x_Bar(l,i) = x_Bar(l,i)-
Alpha*(f-Pairs(p,end))/b*(y_Bar(l)-f)*z(l)*
(2*(Pairs(p,i)-x_Bar(l,i))/(Sigma(l,i)^2));
                        Sigma(l,i) = Sigma(l,i)-
Alpha*(f-Pairs(p,end))/b*(y_Bar(l)-f)*z(l)*
(2*((Pairs(p,i)-x_Bar(l,i))^2)/(Sigma(l,i)^3));
                    end
                end
                if (f-Pairs(p,end))<epsilon
                    break;
                end
            end
end
```

Results

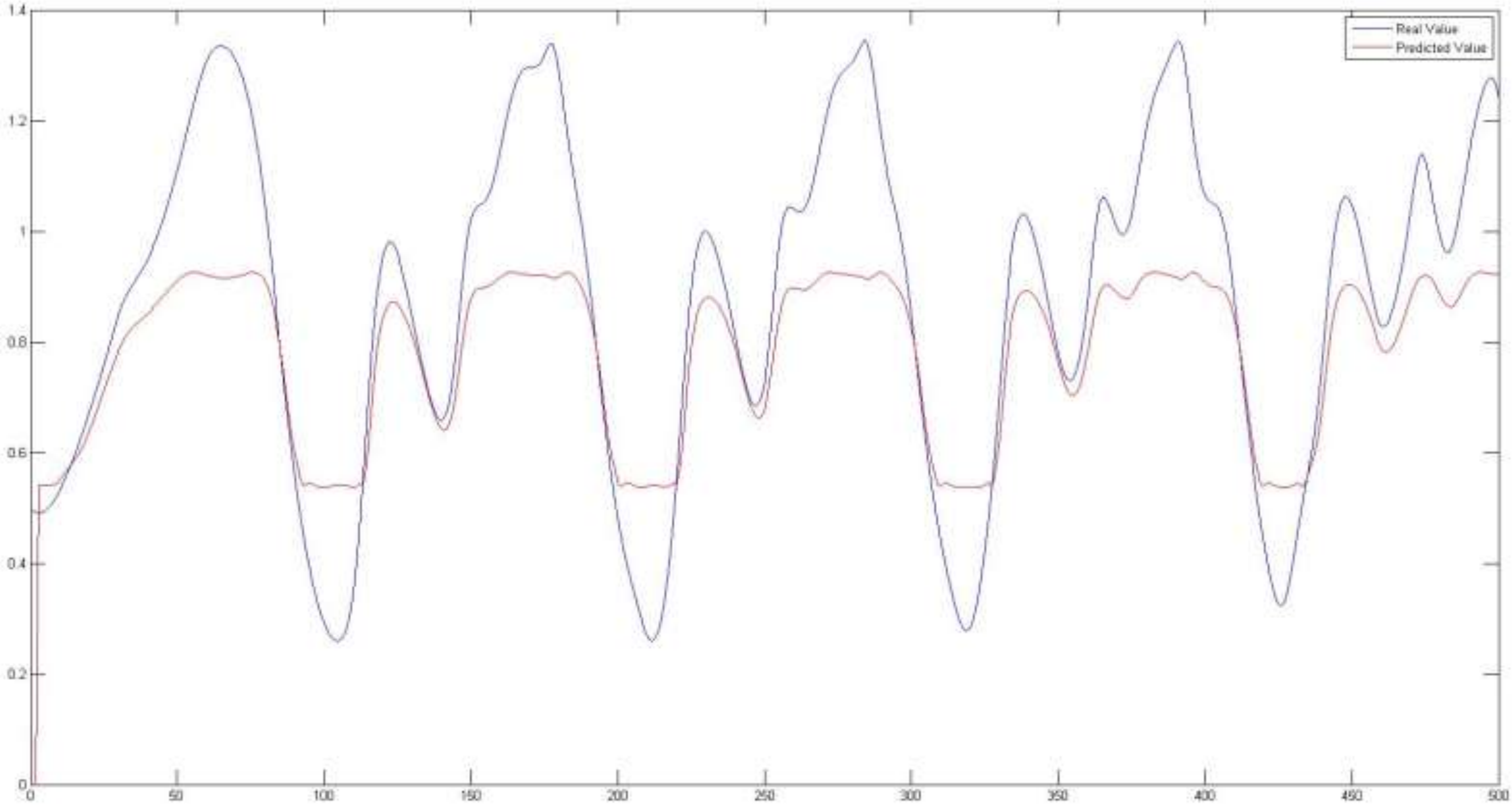
After updating, the fuzzy system is ready for operation. Here are the parameters and the result.

Number of Rules: 30

Training Ratio: 0.5

Number of iteration for each point: 100

Desired Error: 0



Number of Inputs: 1

Number of Data Pairs: 300

Number of Samples: 500

Mean Square Error: 0.0385

Mean Absolute Error: 0.1558