Radial Basis Function Networks for Six Functions by James Pate Williams, Jr.

I used 64 training examples and sixteen test examples. The domain of the abscissas (independent variables) was the open interval (-1,1) randomly sampled. The standard old school pseudorandom number generator was utilized.

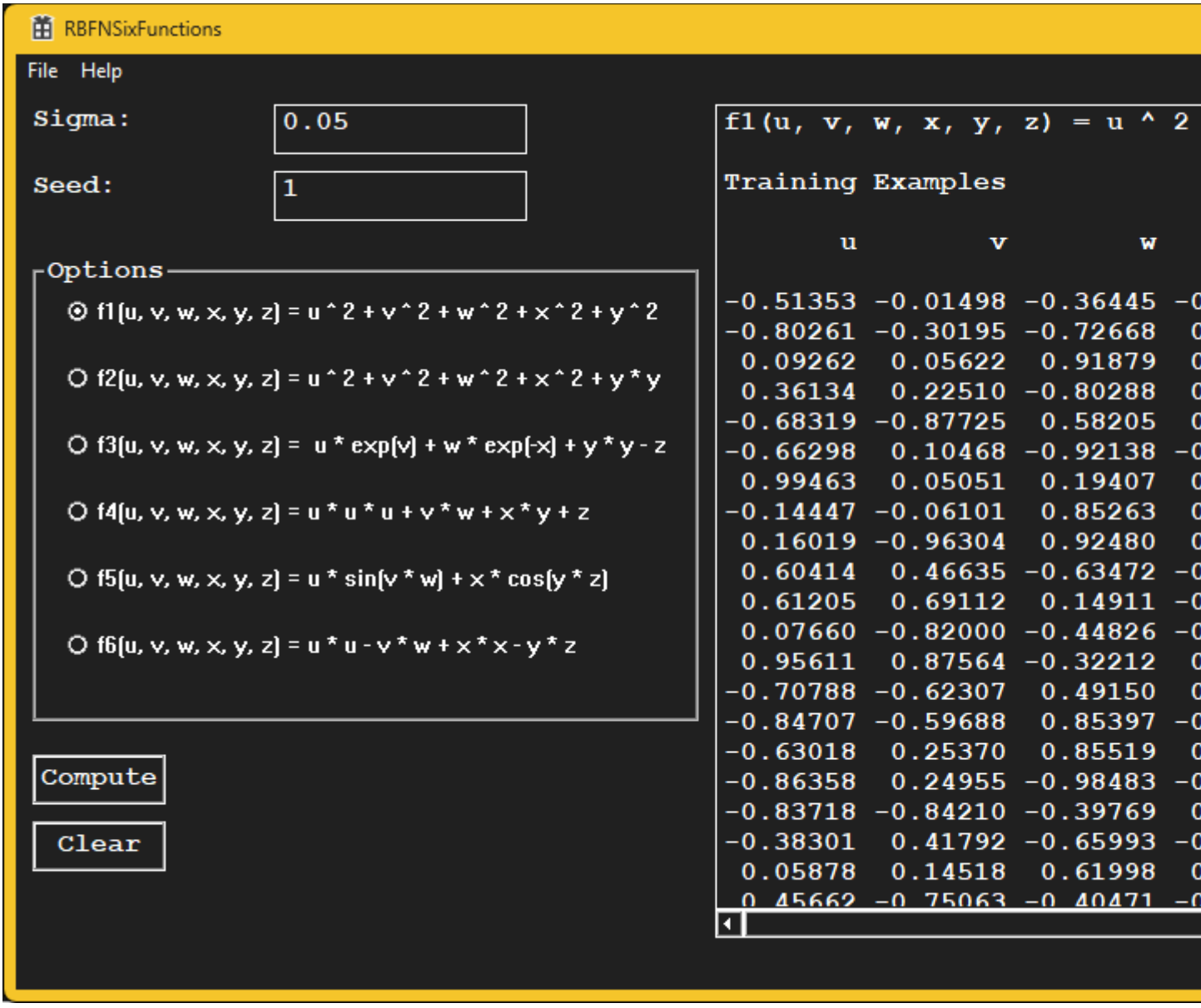

Figure 1 User Interface with Six-Dimensional Functions

```
static double f(std::vector<double> x)
{
    if (numberFunction == 0)
        return
        x[0] * x[0] + x[1] * x[1] + x[2] * x[2] +
        x[3] * x[3] + x[4] * x[4] + x[5] * x[5];
    else if (numberFunction == 1)
        return
        x[0] * x[0] + x[1] * x[1] + x[2] * x[2] +
        x[3] * x[3] + x[4] * x[4] * x[4] + x[5] * x[5] * x[5];
    else if (numberFunction == 2)
        return
        x[0] * std::exp(x[1]) + x[2] * std::exp(-x[3]) +
        x[4] * x[4] - x[5] * x[5] * x[5];
    else if (numberFunction == 3)
        return
        x[0] * x[0] * x[0] + x[1] * x[2] + x[3] * x[4] + x[5];
    else if (numberFunction == 4)
        return
        x[0] * std::sin(x[1] * x[2]) + x[3] * std::cos(x[4] *
x[5]);
    else if (numberFunction == 5)
        return
        x[0] * x[0] - x[1] * x[2] + x[3] * x[3] - x[4] * x[5];
    return 0.0;
}
```

Training Sigma	f1 MSE
0.9	1.49371833E+00
0.8	1.49594657E+00
0.7	1.45737968E+00
0.6	1.34604119E+00
0.5	1.13708901E+00
0.4	7.63693281E-01
0.3	3.53341489E-01
0.2	9.26873985E-02
0.1	7.07739459E-04
0.05	2.72001215E-12

Table 1 Function 1 Mean Square Error Data

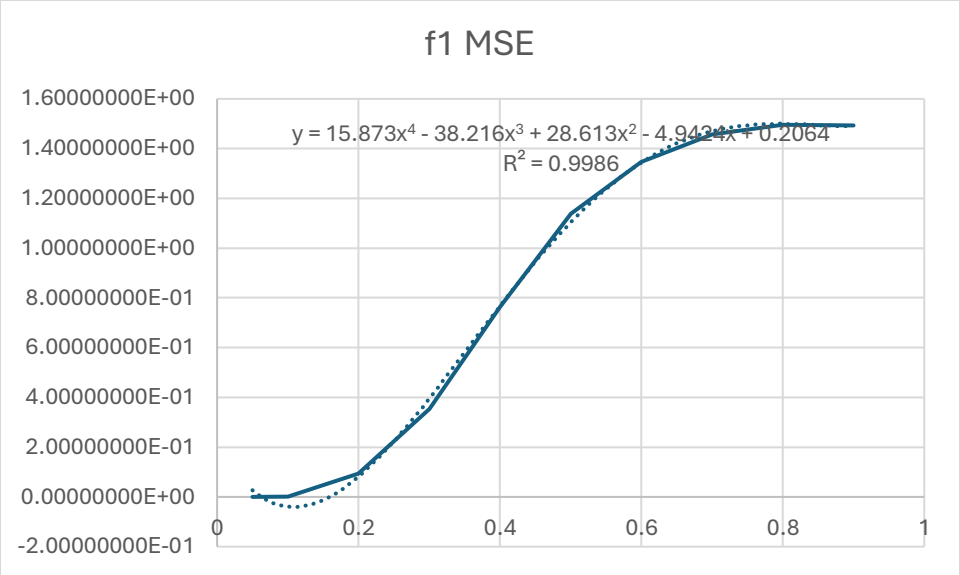

Figure 2 Function 1 Mean Square Error Graph

Training Sigma	f2 MSE
0.9	1.15203691E+00
0.8	1.18083230E+00
0.7	1.17278553E+00
0.6	1.09693507E+00
0.5	9.25140258E-01
0.4	6.02849428E-01
0.3	2.66887340E-01
0.2	6.99549041E-02
0.1	5.43866528E-04
0.05	2.09052282E-12

Table 2 Function 2 Mean Square Error Data

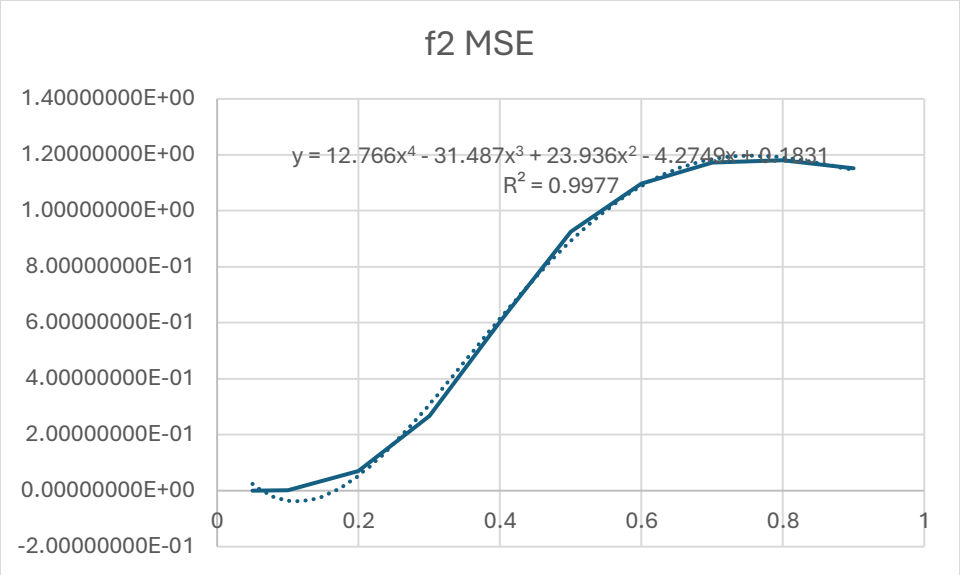

Figure 3 Function 2 Mean Square Error Graph

Training Sigma	f3 MSE
0.9	9.16365706E-01
0.8	8.74074775E-01
0.7	8.24999850E-01
0.6	7.48014738E-01
0.5	6.26520855E-01
0.4	4.21512349E-01
0.3	2.03720990E-01
0.2	5.68283332E-02
0.1	4.78114220E-04
0.05	1.83875352E-12

Table 3 Function 3 Mean Square Error Data

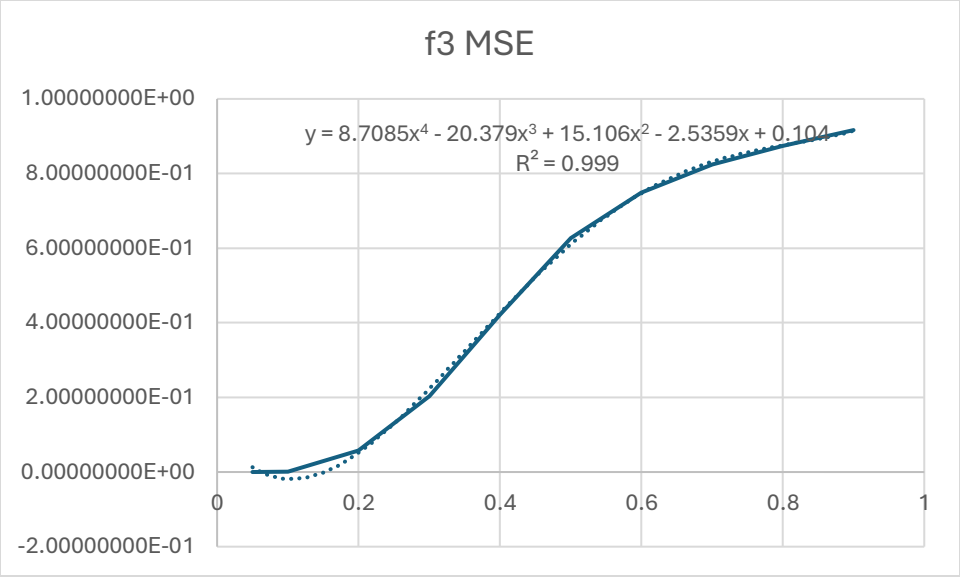

Figure 4 Function 3 Mean Square Error Graph

Training Sigma	f4 MSE
0.9	8.09747775E-01
0.8	7.35778324E-01
0.7	6.71885887E-01
0.6	5.92703176E-01
0.5	4.68174966E-01
0.4	2.71726941E-01
0.3	1.05063883E-01
0.2	3.31253487E-02
0.1	2.73966961E-04
0.05	1.05311947E-12

Table 4 Function 4 Mean Square Error Data

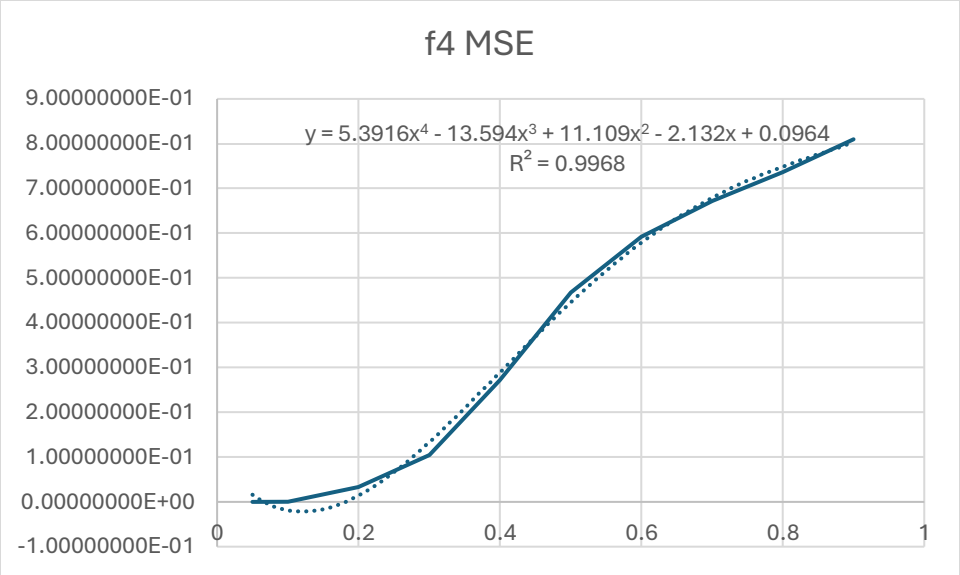

Figure 5 Function 4 Mean Square Error Graph

Training Sigma	f5 MSE
0.9	5.38334641E-01
0.8	4.78267840E-01
0.7	4.28172796E-01
0.6	3.83405308E-01
0.5	3.23627709E-01
0.4	2.19591474E-01
0.3	1.06385152E-01
0.2	2.39187617E-02
0.1	1.73213675E-04
0.05	6.65859542E-13

Table 5 Function 5 Mean Square Error Data

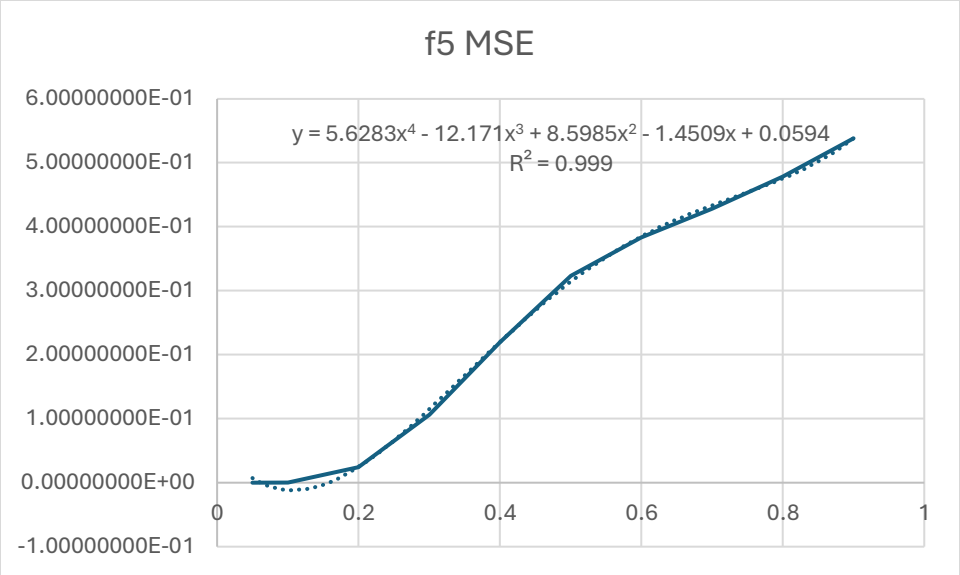

Figure 6 Function 5 Mean Square Error Graph

Training Sigma	f6 MSE
0.9	6.90550944E-01
0.8	6.66274111E-01
0.7	6.48236025E-01
0.6	6.14305851E-01
0.5	5.23434289E-01
0.4	3.22991425E-01
0.3	1.43818011E-01
0.2	4.56872458E-02
0.1	3.72607235E-04
0.05	1.43232485E-12

Table 6 Function 6 Mean Square Error Data

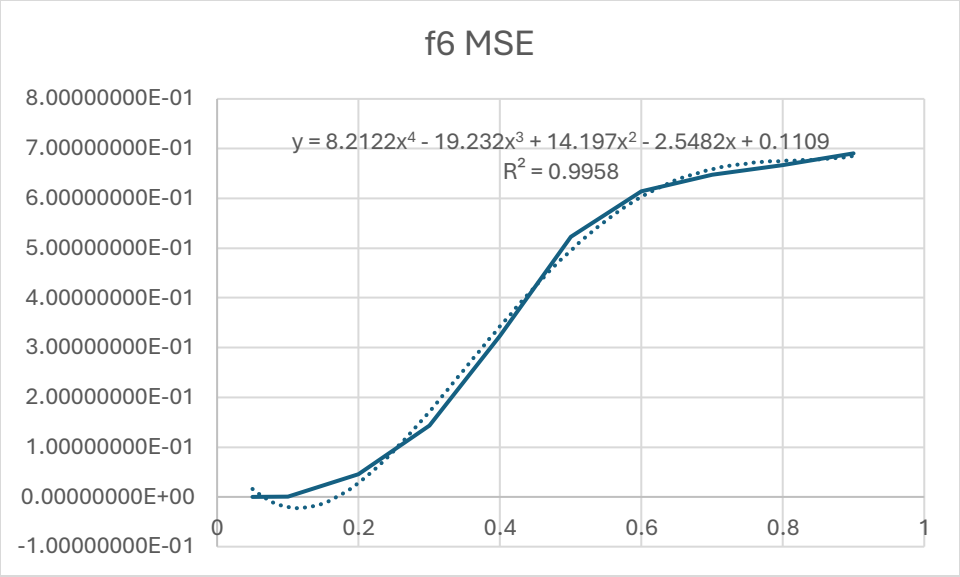

Figure 7 Function 6 Mean Square Error Graph