Appendix A

Tables

Cumulative Variance			
Eigenvalue	**Proportion**	**Cumulative**	**Component**
2,1155	0,5289	0,5289	1
0,9593	0,2398	0,7687	2
0,6563	0,1641	0,9328	3
0,2690	0,0672	1,0000	4

Table A.1: Example of PC Analysis. Correlation Matrix and Variance of Components

Eigenvectors Matrix				
PC1	**PC2**	**PC3**	**PC4**	
0,5080	-0,5356	0,3822	0,5559	**PTT_IPG_PPG**
0,6110	-0,2419	-0,0579	-0,7515	**PTT_QRS_IBP**
0,3487	0,7410	0,5740	0,0007	**PTT_QRS_IMP**
0,4971	0,3250	-0,7219	0,3551	**PTT_QRS_IPG**

Table A.2: Example of PC Analysis. Eigenvectors.

PC1	0.611 PTT_QRS_IBP+0.508 PTT_IPG_PPG+0.497 PTT_QRS_IPG+0.349 PTT_QRS_IMP
PC2	0.741 PTT_QRS_IMP-0.536 PTT_IPG_PPG+0.325 PTT_QRS_IPG-0.242 PTT_QRS_IBP
PC3	-0.722 PTT_QRS_IPG+0.574 PTT_QRS_IMP+0.382 PTT_IPG_PPG-0.058 PTT_QRS_IBP
PC4	-0.752 PTT_QRS_IBP+0.556 PTT_IPG_PPG+0.355 PTT_QRS_IPG+0.001 PTT_QRS_IMP

Table A.3: Example of PC Analysis. Expresion of the components as linear transformations of the input features.

	x2 Input Patterns			
	8 Hidden Layers		10 Hidden layers	
	MAE *(mmHg)*	STD *(mmHg)*	MAE *(mmHg)*	STD *(mmHg)*
4	3,5858	4,4020	3,5868	4,4426
6	3,4974	4,3944	3,5328	4,4041
8	3,3636	4,3685	3,5588	4,3430
10	3,5782	4,3363	3,5712	4,3783
12	3,1390	4,1288	3,1725	4,1345
14	3,1609	4,2265	3,2927	4,3551
10cc	3,1458	4,1842	3,1904	4,2346
11cc	3,0857	4,0596	3,1310	4,0596
12cc	3,2395	4,4203	3,1894	4,4765
13cc	3,2404	4,2520	3,3278	4,6611

Table A.4: Multilayer Perceptron Simulations with x^2 input patterns

	x3 Input Patterns			
	8 Hidden Layers		10 Hidden layers	
	MAE *(mmHg)*	STD *(mmHg)*	MAE *(mmHg)*	STD *(mmHg)*
4	3,5424	4,4226	3,5885	4,4873
6	3,4621	4,3489	3,5504	4,3919
8	3,3726	4,3235	3,5910	4,3779
10	3,5542	4,4215	3,5588	4,3567
12	3,1516	4,1277	3,1974	4,1719
14	3,2305	4,3280	3,3850	5,3521
10cc	3,1544	4,1916	3,1993	4,1439
11cc	3,1771	4,1397	3,1856	4,1348
12cc	3,3535	5,2612	3,3659	5,4116
13cc	3,3716	5,3593	3,3793	4,7360

Table A.5: Multilayer Perceptron Simulations with x^3 input patterns

	sqrtx Input Patterns			
	8 Hidden Layers		**10 Hidden layers**	
	MAE *(mmHg)*	STD *(mmHg)*	MAE *(mmHg)*	STD *(mmHg)*
4	3,5403	4,4491	3,6137	4,4268
6	3,5725	4,3829	3,5167	4,4730
8	3,5577	4,4944	3,5353	4,4708
10	3,6091	4,4798	3,5633	4,4678
12	3,1611	4,1626	3,0858	4,1594
14	3,2302	4,4306	3,1792	4,2060
10cc	3,2506	4,4169	3,3245	4,4135
11cc	3,1488	4,1555	3,3139	4,4443
12cc	3,1837	4,2579	3,2335	4,4170
13cc	3,1668	4,2852	3,1487	4,1713

Table A.6: Multilayer Perceptron Simulations with $\sqrt{x}$ input patterns

	logx Input Patterns			
	8 Hidden Layers		**10 Hidden layers**	
	MAE *(mmHg)*	STD *(mmHg)*	MAE *(mmHg)*	STD *(mmHg)*
4	3,5428	4,4024	3,5911	4,4445
6	3,5549	4,3738	3,5361	4,5194
8	3,5423	4,4754	3,5116	4,4579
10	3,6010	4,5300	3,5572	4,5290
12	3,3074	4,4705	3,2171	4,1825
14	3,1683	4,1142	3,2061	4,2491
10cc	3,2855	4,2951	3,2677	4,1938
11cc	3,2153	4,1799	3,2081	4,1631
12cc	3,0112	4,0224	3,185	4,4074
13cc	3,1074	4,1968	3,1206	4,1141

Table A.7: Multilayer Perceptron Simulations with $log(x)$ input patterns

	8 Hidden Neurones		10 Hidden Neurones	
PCA Inputs	MAE ($mmHg$)	STD($mmHg$)	MAE($mmHg$)	STD($mmHg$)
4	5,1148	6,7684	5,1000	6,6863
6	3,5689	4,6798	3,5205	4,4816
8	3,5613	4,5340	3,5414	4,4765
10	3,4676	4,6726	3,7381	4,8660
12	3,6000	4,7551	3,6827	5,5243
14	3,4558	4,5201	3,7243	5,9566

Table A.8: Weka Simulations with PCA inputs. Feature Subset Selection. Transformation: $\mathbf{x}^2$.

	8 Hidden Neurones		10 Hidden Neurones	
PCA Inputs	MAE ($mmHg$)	STD($mmHg$)	MAE($mmHg$)	STD($mmHg$)
4	5,0217	6,5202	4,9687	6,4044
6	3,5299	4,6016	3,5317	4,4631
8	3,5450	4,5443	3,5463	4,5426
10	3,5344	4,7507	3,5510	4,7337
12	3,6345	5,1148	3,5572	4,7224
14	3,6049	4,6654	3,7563	6,4134

Table A.9: Weka Simulations with PCA inputs. Feature Subset Selection. Transformation: $\mathbf{x}^3$.

	8 Hidden Neurones		10 Hidden Neurones	
PCA Inputs	MAE ($mmHg$)	STD($mmHg$)	MAE($mmHg$)	STD($mmHg$)
4	5,2067	6,7678	5,2014	6,7635
6	3,6126	4,6194	3,5363	4,6492
8	3,4922	4,6126	3,5085	4,6135
10	3,6548	4,9670	3,6629	4,8256
12	3,6292	4,9246	3,6895	5,8536
14	3,2975	4,5906	3,7193	5,4456

Table A.10: Weka Simulations with PCA inputs. Feature Subset Selection. Transformation: $\sqrt{\mathbf{x}}$.

	8 Hidden Neurones		10 Hidden Neurones	
PCA Inputs	MAE ($mmHg$)	STD($mmHg$)	MAE($mmHg$)	STD($mmHg$)
4	5,2087	6,7544	5,1723	6,7422
6	3,5251	4,6514	3,4798	4,5794
8	3,5410	4,6321	3,5420	4,6512
10	3,6975	4,8522	3,6964	4,8490
12	3,6985	4,9601	3,7691	5,1577
14	3,7712	5,4501	3,6796	5,2144

Table A.11: Weka Simulations with PCA inputs. Feature Subset Selection. Transformation: $log(\mathbf{x})$.

Search Direction		6 Hidden Layers	8 Hidden Layers	10 Hidden Layers
Forward	Subset	2b, 9b, 10b, 11b, 12b, 13b, 15b, 16b, 18b, 19b	2b, 3b, 6b, 9b, 10b, 11b, 12b, 13b, 15b, 17b, 18b, 19b	2b, 3b, 7b, 8b, 10b, 11b, 12b, 13b, 15b, 16b, 18b, 19b
	MAE	2,7832	3,6104	2,6386
	STD	4,5193	3,6065	3,4054
Backward	Subset	1b, 2b, 6b, 7b, 9b, 10b, 11b, 12b, 13b, 14b, 16b, 18b, 19b	1b, 2b, 3b, 6b, 10b, 12b, 13b, 17b, 18b, 19b	1b, 3b, 10b, 12b, 13b, 16b, 18b, 19b
	MAE	2,6523	2,6164	2,5947
	STD	3,6109	3,4677	3,7554

Table A.12: Subset from Wrapper analysis for x^2 input patterns.

Search Direction		6 Hidden Layers	8 Hidden Layers	10 Hidden Layers
Forward	Subset	2c, 5c, 6c, 7c, 8c, 9c, 10c, 11c, 12c, 13c, 18c, 19c	3c, 5c, 6c, 7c, 8c, 10c, 11c, 12c, 13c, 18c, 19c	2c, 3c, 7c, 8c, 10c, 11c, 13c, 18c, 19c
	MAE	3,3223	3,2155	3,5413
	STD	3,9422	4,2002	3,9495
Backward	Subset	2c, 5c, 6c, 8c, 10c, 11c, 12c, 13c, 15c, 16c, 18c, 19c	1c, 3c, 5c, 10c, 11c, 13c, 16c, 18c, 19c	1c, 3c, 4c, 5c, 6c, 7c, 8c, 9c, 10c, 11c, 13c, 14c, 17c, 18c, 19c
	MAE	3,2677	3,0531	3,7351
	STD	4,0997	4,9639	6,8846

Table A.13: Subset from Wrapper analysis for x^3 input patterns.

Search Direction		6 Hidden Layers	8 Hidden Layers	10 Hidden Layers
Forward	Subset	2d, 3d, 7d, 8d, 9d, 10d, 11d, 12d, 13d, 16d, 17d, 18d, 19d	5d, 7d, 8d, 10d, 11d, 12d, 13d, 17d, 18d, 19d	1d, 4d, 7d, 8d, 10d, 11d, 12d, 13d, 16d, 17d, 18d, 19d
	MAE	2,6570	2,4745	2,5077
	STD	3,5491	3,6722	4,0219
Backward	Subset	1d, 3d, 4d, 5d, 7d, 8d, 9d, 10d, 11d, 12d, 13d, 16d, 17d, 18d, 19d	1d, 3d, 4d, 6d, 8d, 9d, 11d, 12d, 13d, 16d, 17d, 18d, 19d	1d, 3d, 4d, 9d, 11d, 12d, 13d, 17d, 18d, 19d
	MAE	2,5031	2,4215	2,6129
	STD	3,5260	4,2427	4,3692

Table A.14: Subset from Wrapper analysis for $\sqrt{x}$ input patterns.

Search Direction		6 Hidden Layers	8 Hidden Layers	10 Hidden Layers
Forward	Subset	1e, 2e, 5e, 7e, 9e, 10e, 11e, 12e, 13e, 17e, 18e, 19e	7e, 8e, 10e, 11e, 12e, 13e, 18e, 19e	3e, 5e, 10e, 11e, 12e, 13e, 18e, 19e
	MAE	2,5367	2,5359	2,8312
	STD	4,3328	4,0787	3,5189
Backward	Subset	3e, 4e, 10e, 11e, 12e, 13e, 16e, 17e, 18e, 19e	1e, 2e, 3e, 5e, 7e, 9e, 10e, 11e, 12e, 13e, 15e, 16e, 18e, 19e	3e, 8e, 9e, 11e, 12e, 13e, 14e, 16e, 17e, 18e, 19e
	MAE	2,4360	2,4058	2,6117
	STD	3,6314	3,3445	5,0063

Table A.15: Subset from Wrapper analysis for $log(x)$ input patterns.

Appendix B

Graphs

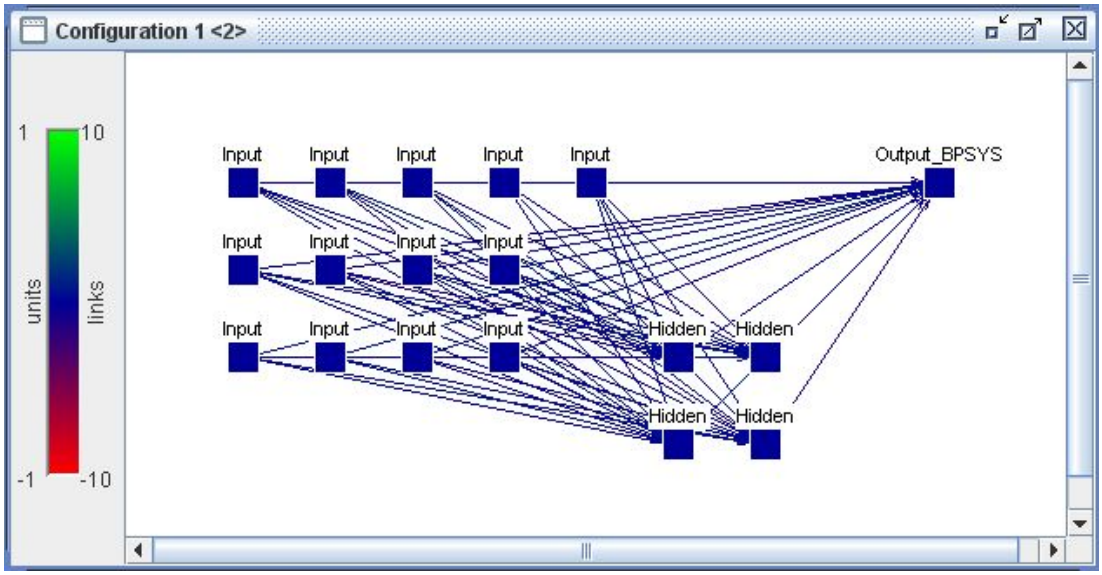

Figure B.1: Architechture of configuration 1. Represented in JavaNNS software.

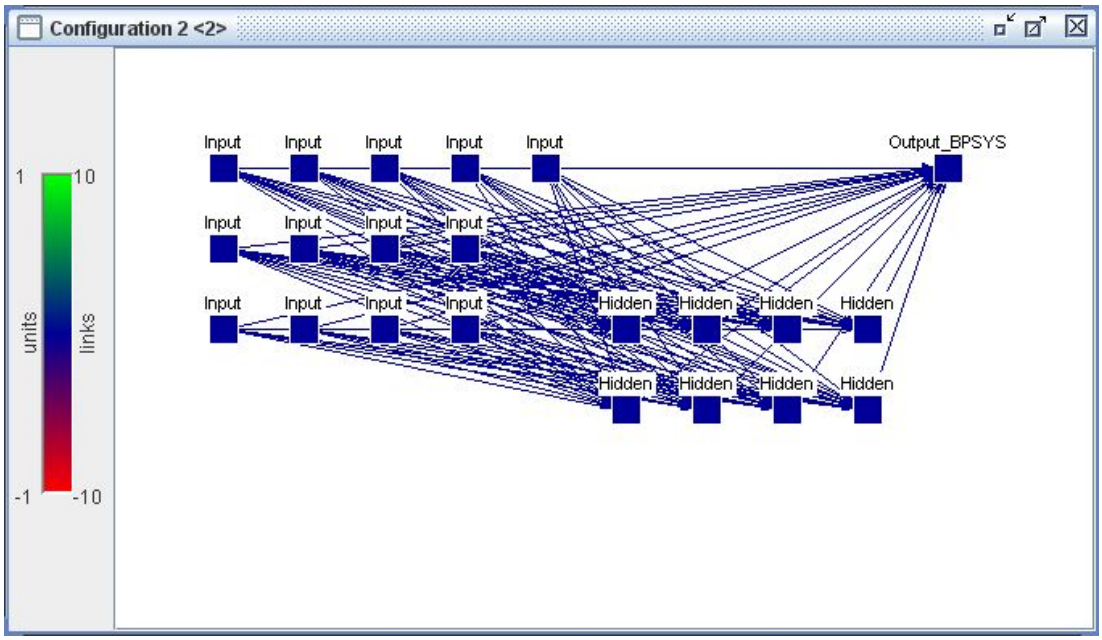

Figure B.2: Architechture of configuration 2. Represented in JavaNNS software.

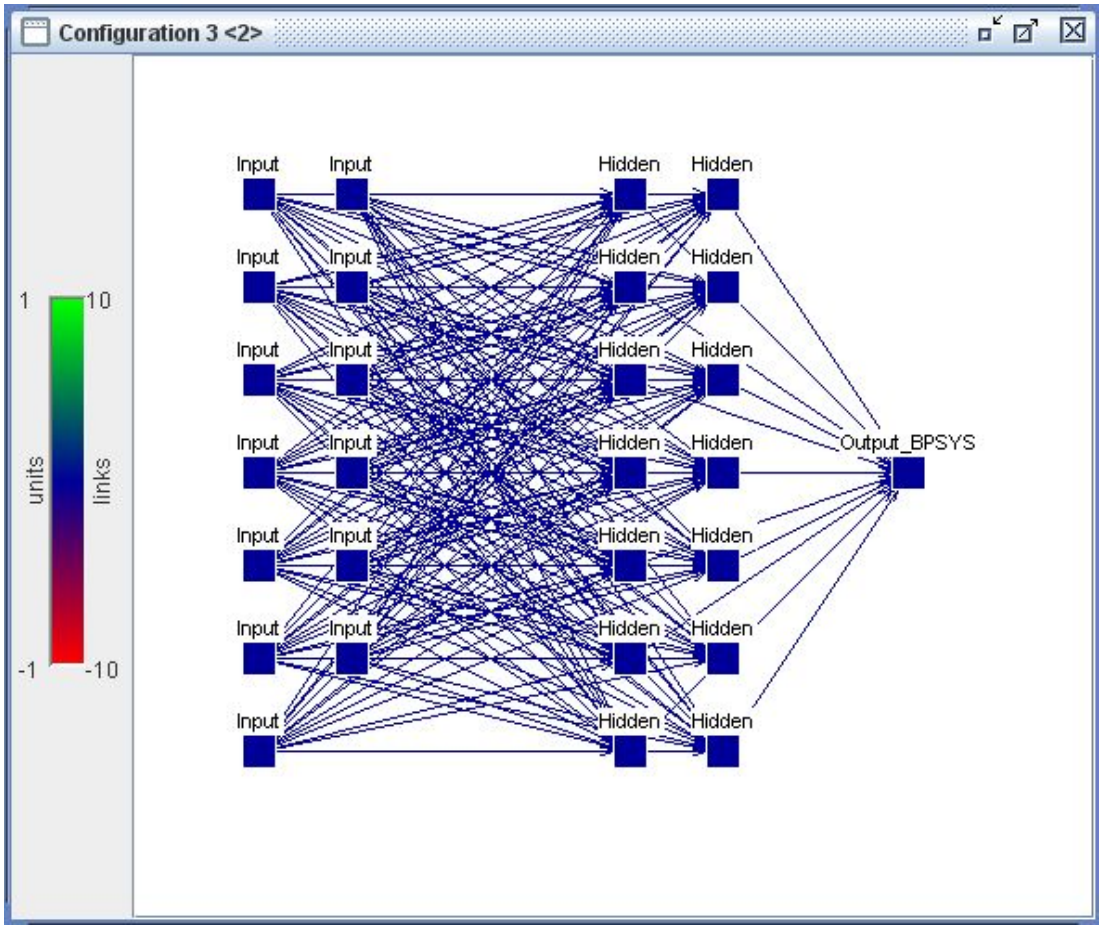

Figure B.3: Architechture of configuration 3. Represented in JavaNNS software.

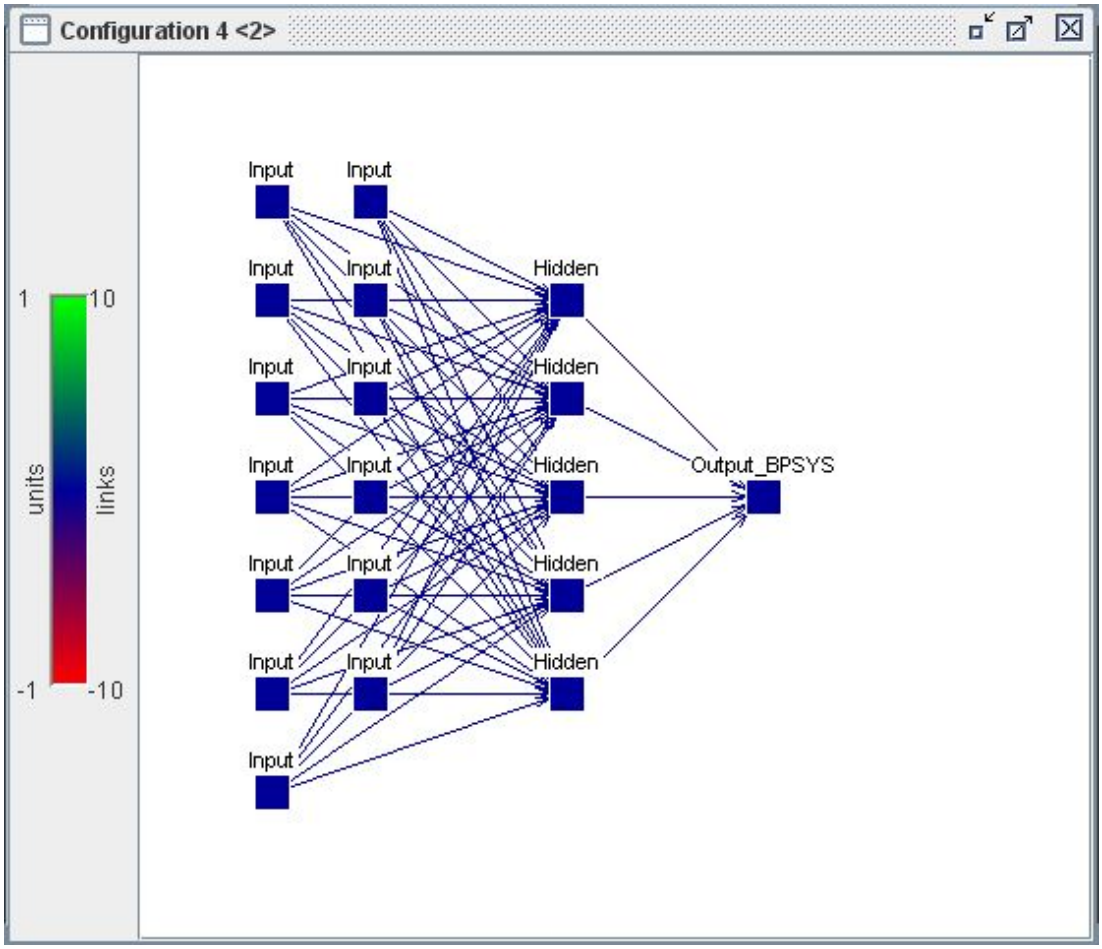

Figure B.4: Architechture of configuration 4. Represented in JavaNNS software.

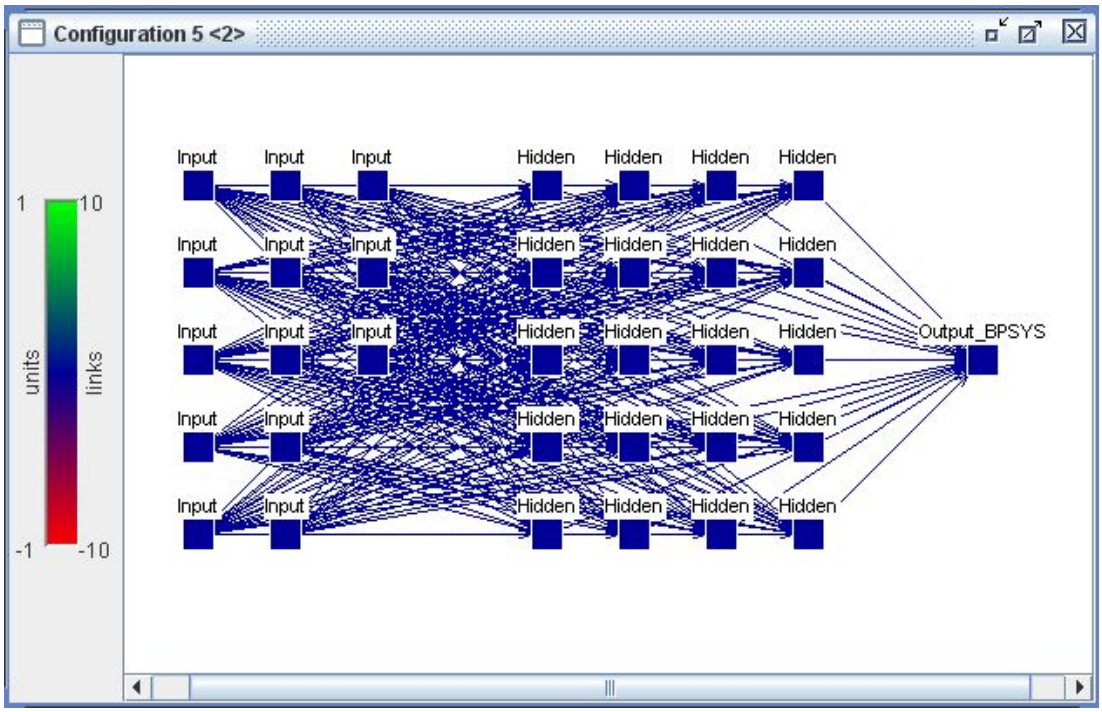

Figure B.5: Architechture of configuration 5. Represented in JavaNNS software.

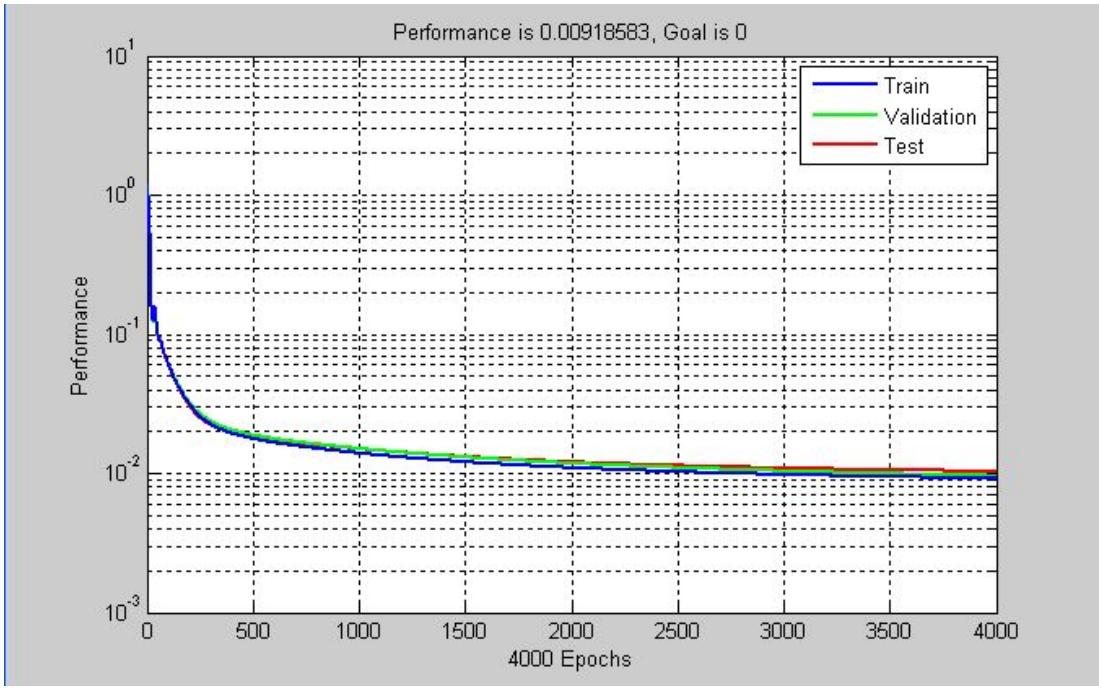

Figure B.6: Performance evolution of configuration 3. 4000 Epochs.

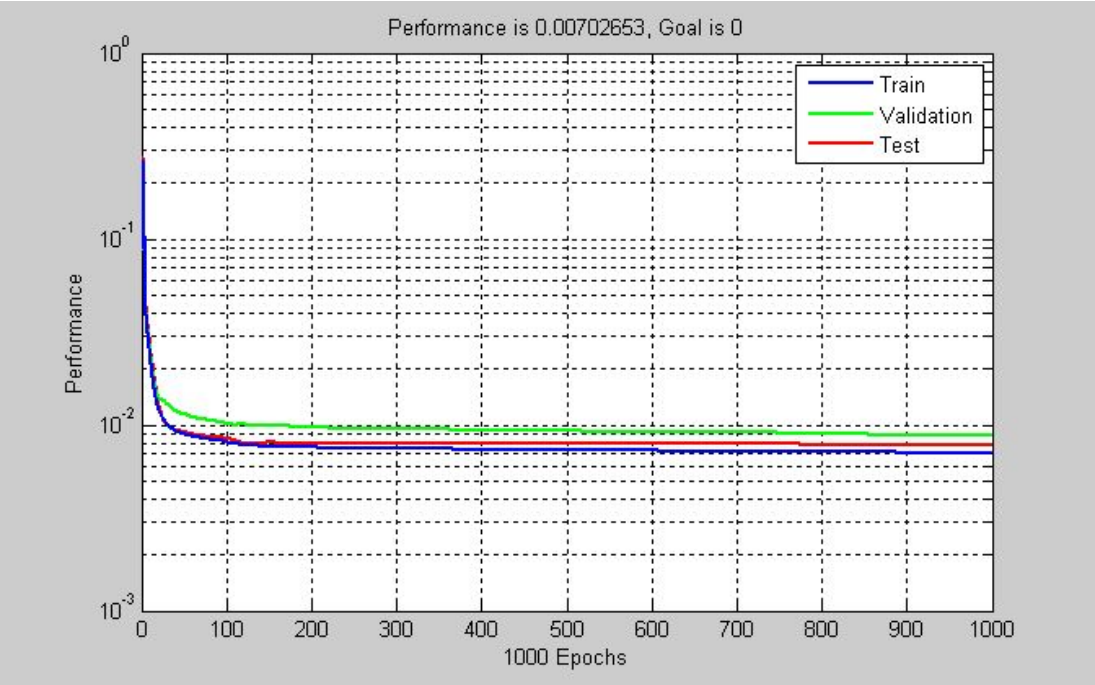

Figure B.7: Performance evolution of configuration 4. 4000 Epochs.

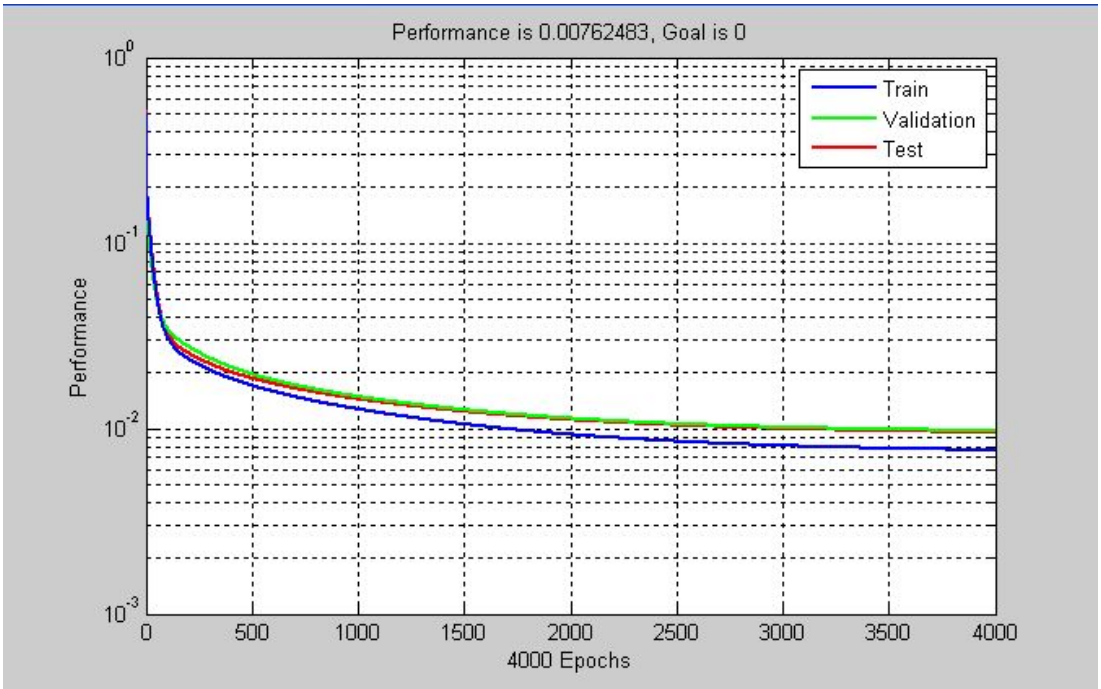

Figure B.8: Performance evolution of configuration 5. 4000 Epochs.

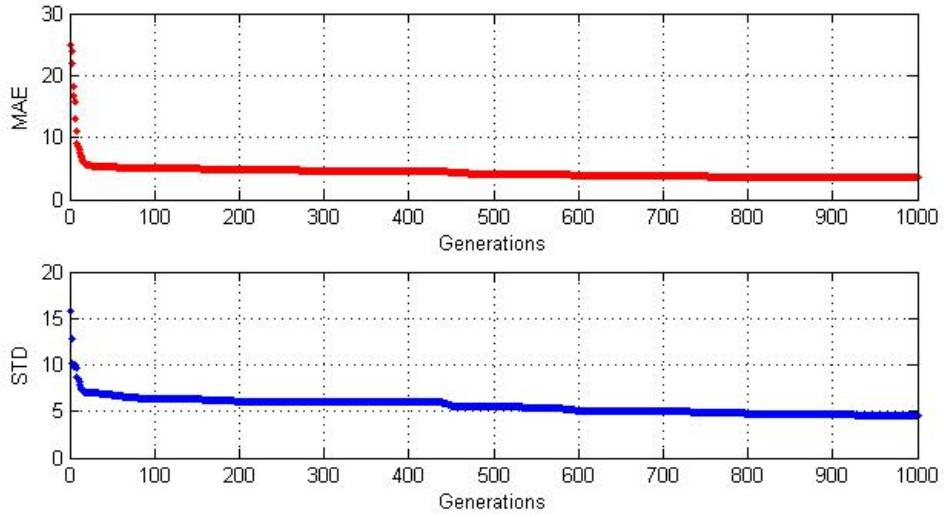

Figure B.9: MAE and STD evolution with GAs for configuration 2

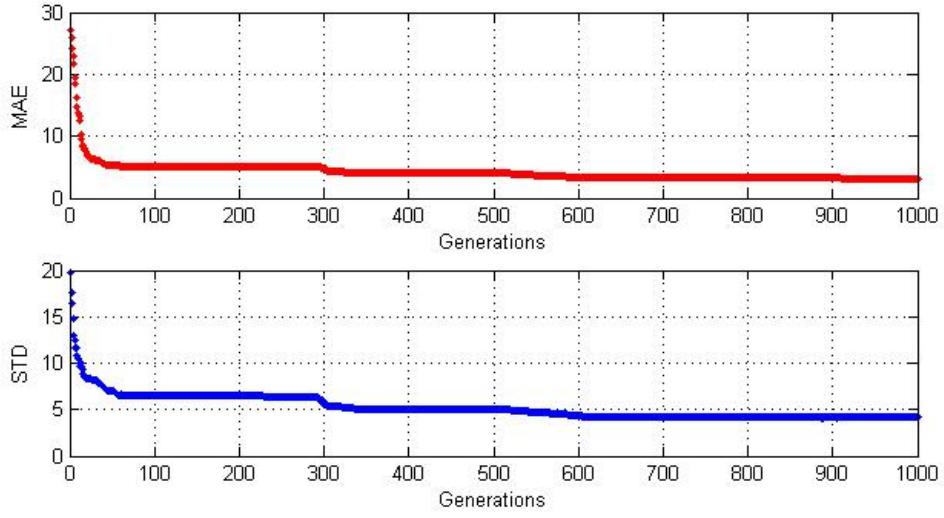

Figure B.10: MAE and STD evolution with GAs for configuration 3

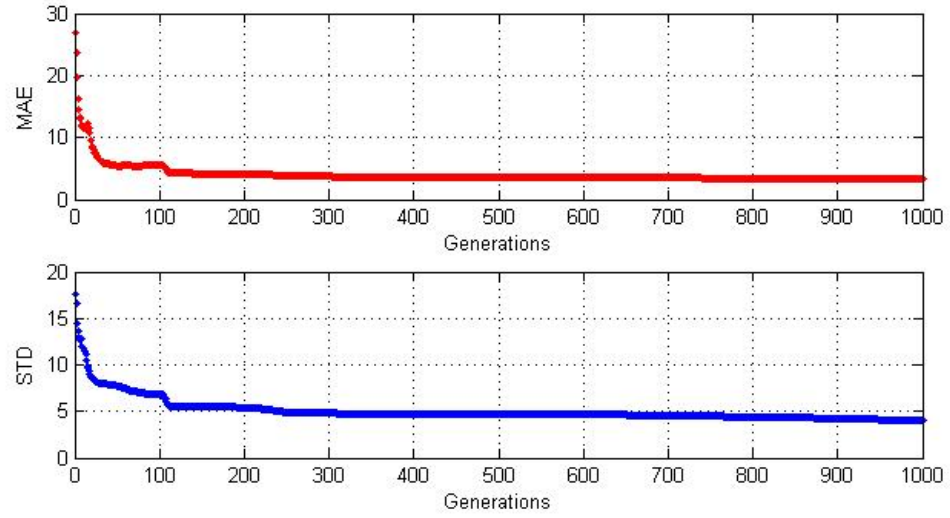

Figure B.11: MAE and STD evolution with GAs for configuration 4

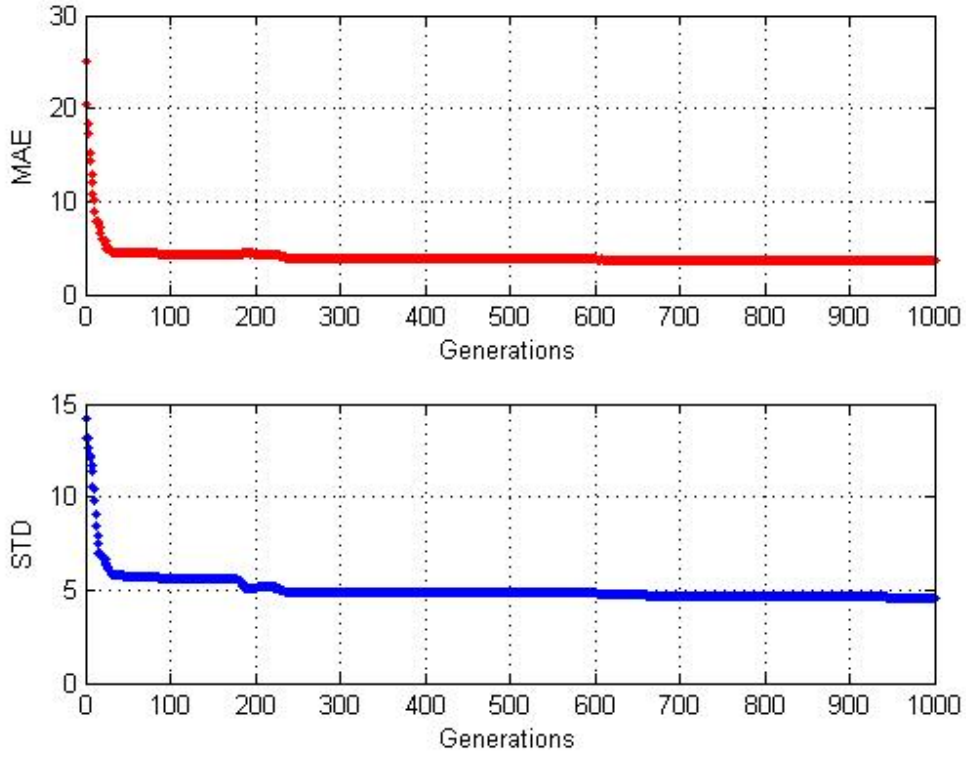

Figure B.12: MAE and STD evolution with GAs for configuration 5

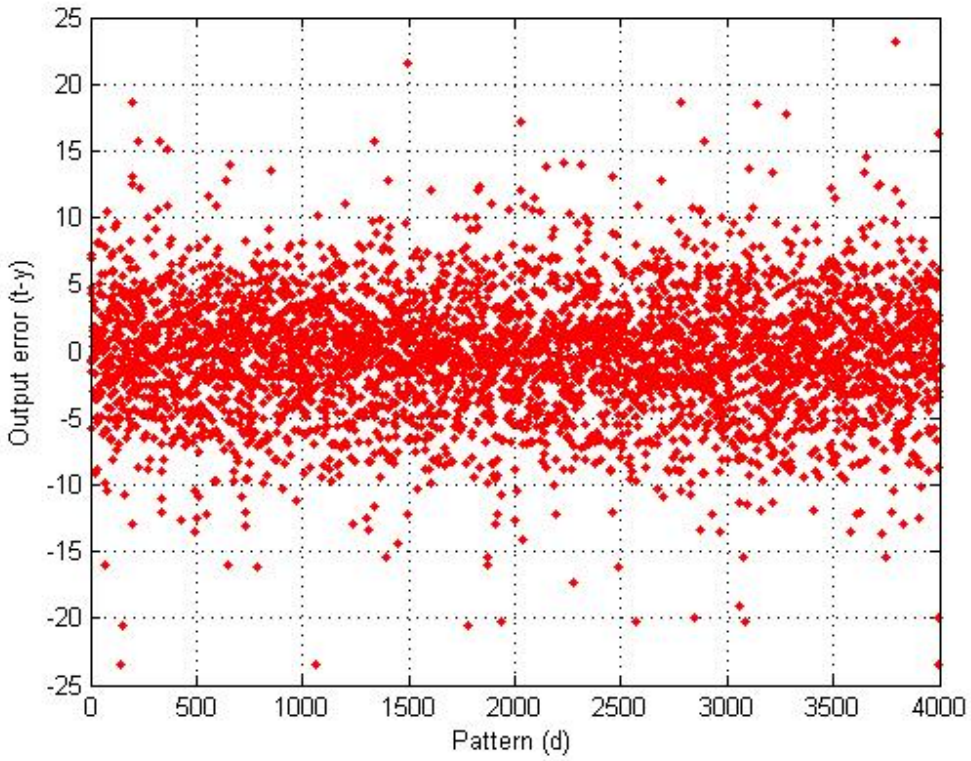

Figure B.13: Output error for 4000 patterns with GAs. Configuration 2. $MAE = 3,5182$ $STD = 4,6473$

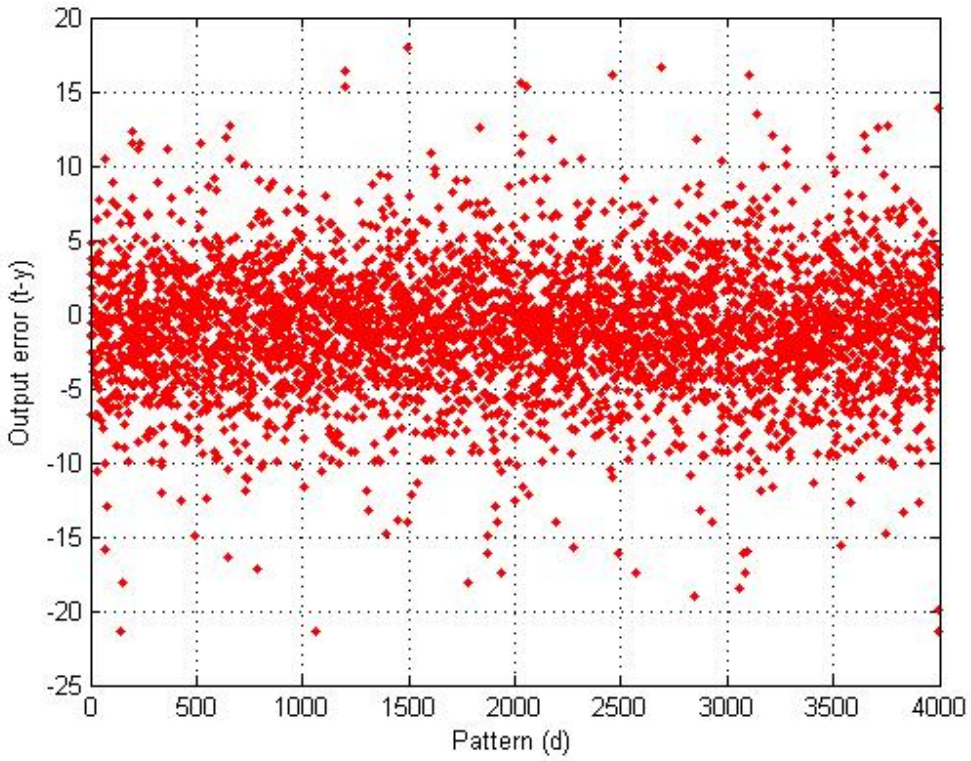

Figure B.14: Output error for 4000 patterns with GAs. Configuration 3. $MAE = 3,3073$ $STD = 4,2457$

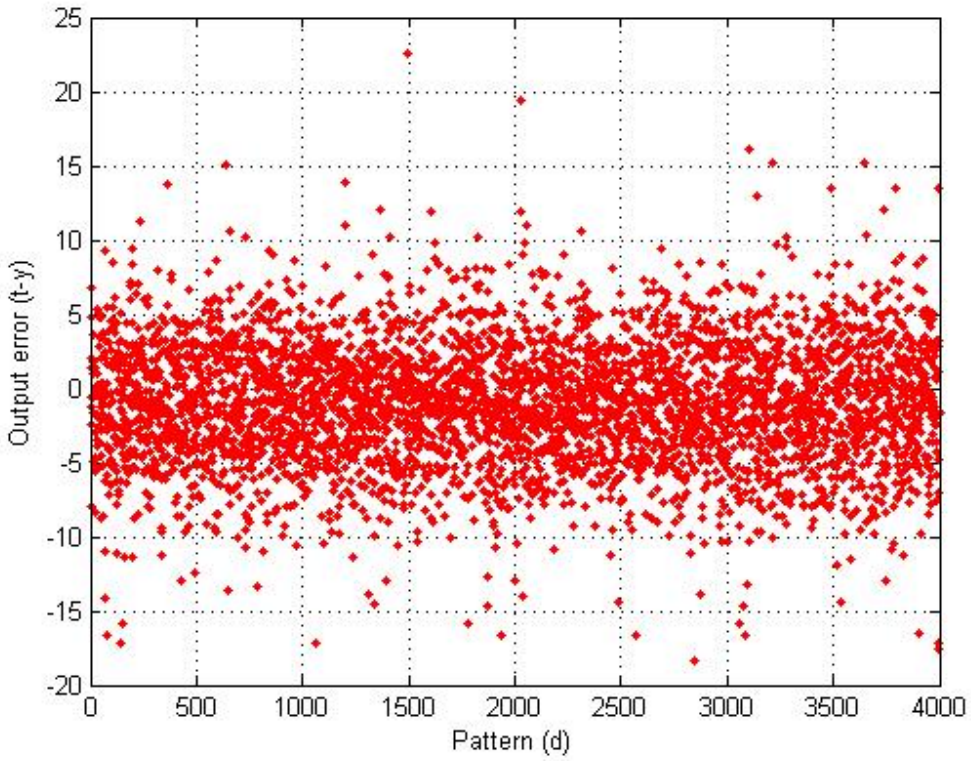

Figure B.15: Output error for 4000 patterns with GAs. Configuration 4. $MAE = 3,3438$ $STD = 4,1528$

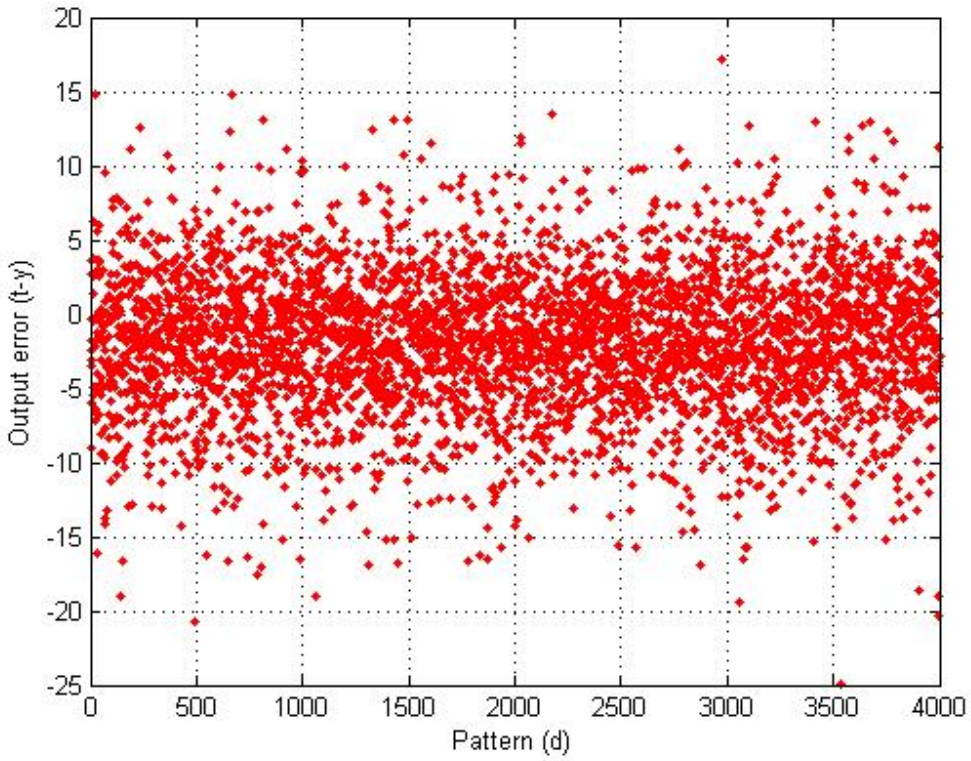

Figure B.16: Output error for 4000 patterns with GAs. Configuration 5. $MAE = 3,8968$ $STD = 4,7209$

Appendix C

Algorithms

Algorithm 5 Pearl Programming Language. Pre-Processing task.

```
open input file (with outliers and empty values)
open output file
for each input pattern_i do
    pattern_i flag = correct
    for each variable in pattern_i do
        if variable_j starts with "0,-0,-1 or -2" then
            pattern_i flag = incorrect
            break
        end if
    end for
end for
for each input pattern_i do
    if pattern_i flag == correct then
        write pattern_i in outputfile
    end if
end for
```