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| REPORT |
| **과제 3**  인공신경망 |





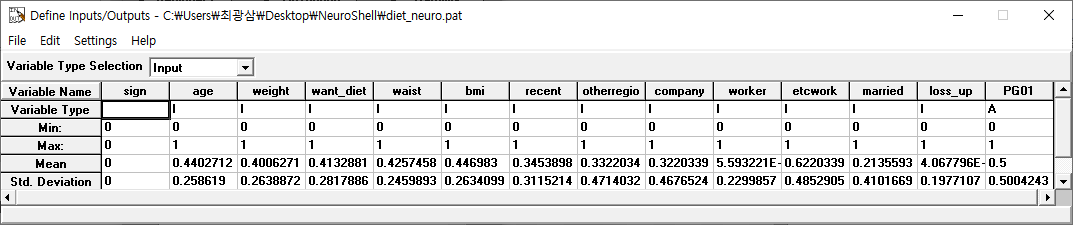
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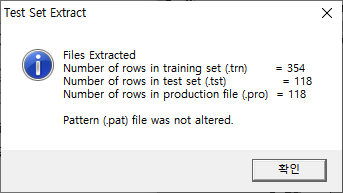
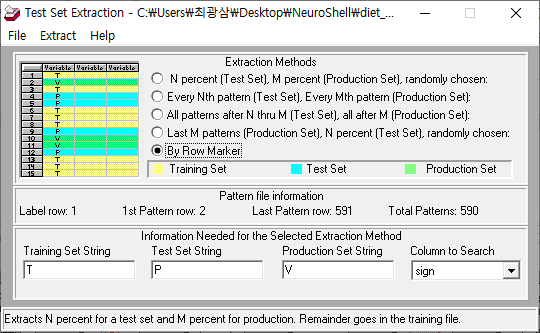
다이어트 전략제품 구매확률을 예측하기 위해서 NeuroSehll2를 이용하여 인공신경망을 구축하였다. 이때 사용된 데이터는 모두590건이며, NeuroShell2 모델 구축이 원활할 수 있도록 RAND 함수를 이용하여 검증용 데이터를 제외한 데이터에 대해 임의로 분류하였다(T: 354건, P: 118건, V: 118건). 더불어 데이터 셋에는 독립표본t검정과 카이제곱검정을 실시하여 로지스틱스 회귀분석에 사용하였을 때 유의미하다고 판단한 12개의 변수를 사용하였다.

1. Define Inputs/Outputs



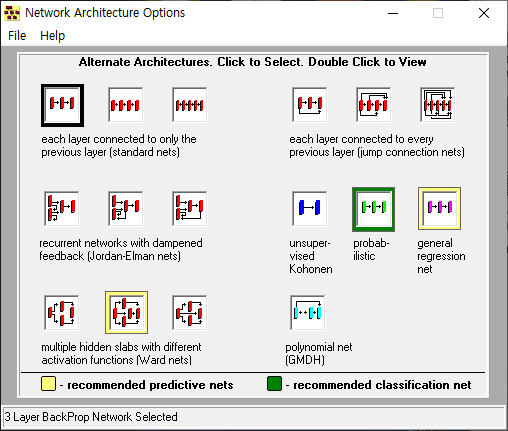
변수에 대해서 age, weight, want\_diet, waist, bmi, otherregion, company, worker, etcwork, married, loss\_up에 대해서는 Input으로 처리하였으며, 전략제품 구매여부를 구분하는 PG01은 Actual Output으로 처리하였다. 데이터의 용도를 구분 짓는 sign 변수에 대해서는 unused로 처리하였다.

1. Test Set Extraction

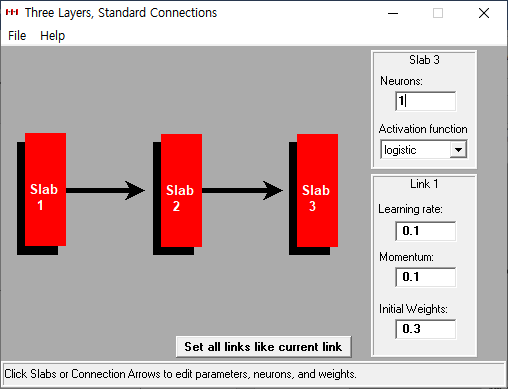
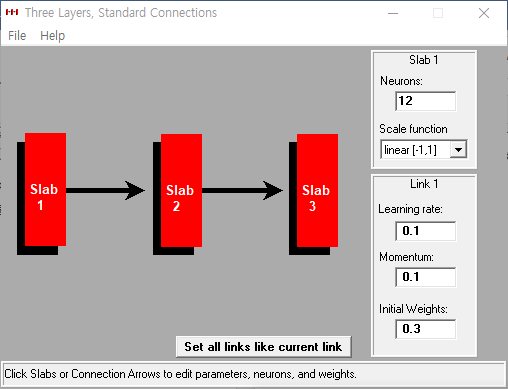


테스트 셋에 대해서는 미리 엑셀에서 Training Set / Test Set / Production Set을 분류하여 데이터를 불러왔으므로 By Row Marker를 선택하였다.

1. Design

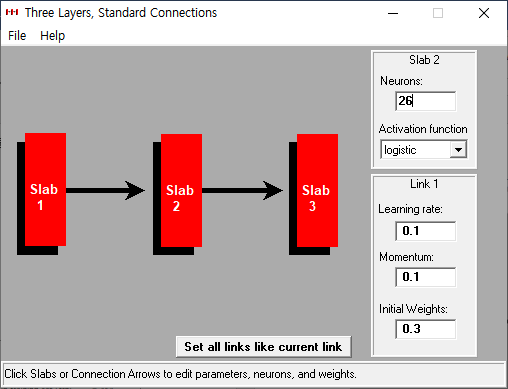


데이터 구조는 위 이미지처럼 설정하였다.

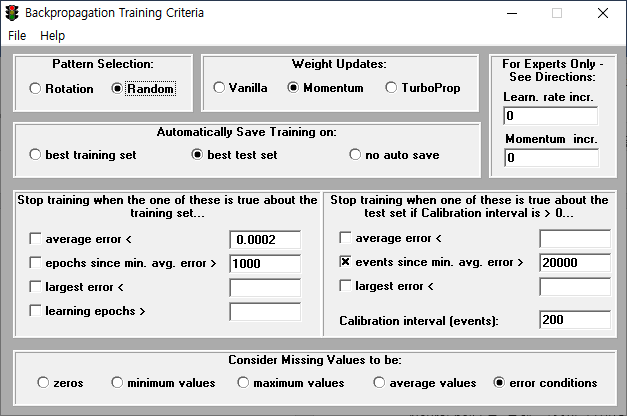


세부 설정에 들어가서, Slab 1(입력층)에 대해서는 사용한 데이터에 12개의 변수가 있으므로 Neurons에 12란 값이 자동으로 설정되어 있는 것을 볼 수 있다. Learning rate, Momentum, Initial Weight값은 일반적으로 사용되는 기본값(각각 0.1, 0.1, 0.3)으로 지정하였다.

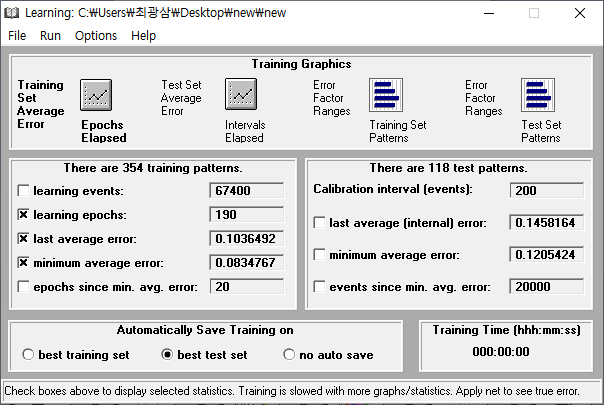
Slab 3(출력층) 역시 기본값인 1로 지정해놓았다.

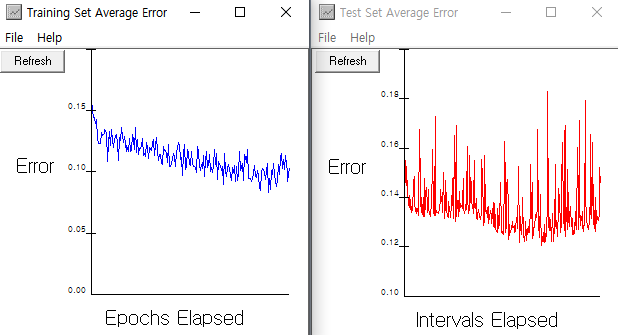


Slab 2(은닉층)의 Neurons값은 일반적으로 Slab 1의 값(12)와 Slab 3의 값(1)을 더한 값(13)의 ~ 2배의 값이 최적값으로 여겨지는데, 여기에서는 2배의 값(26)으로 설정하였다. Activation function은 로지스틱 함수로 설정하였다.



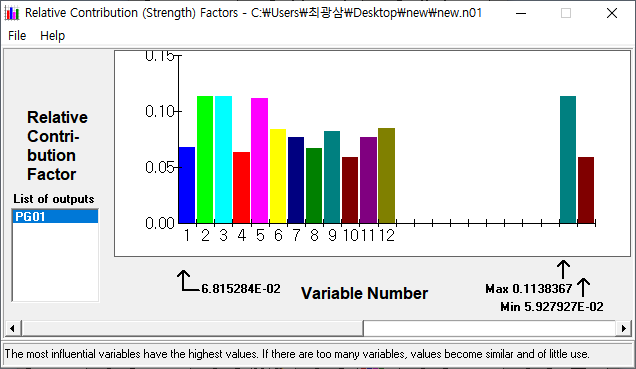
Backpropagation Training Criteria는 테스트 데이터 셋을 평균 에러값의 최소값에 도달한 이후에도 20000번 반복해서 학습하도록 지정하였다. 200번 반복할 때마다 에러가 얼마나 발생하는지 체크하도록 하였다.

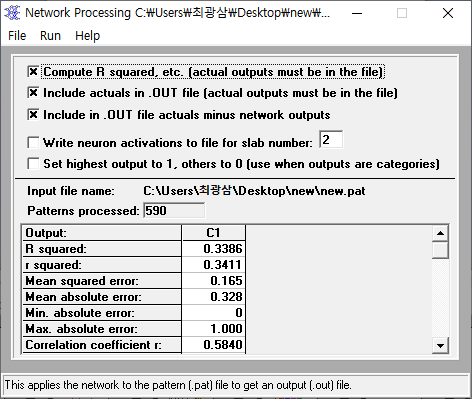




설정이 끝나고 난 뒤에는 Learning을 실시하였다.

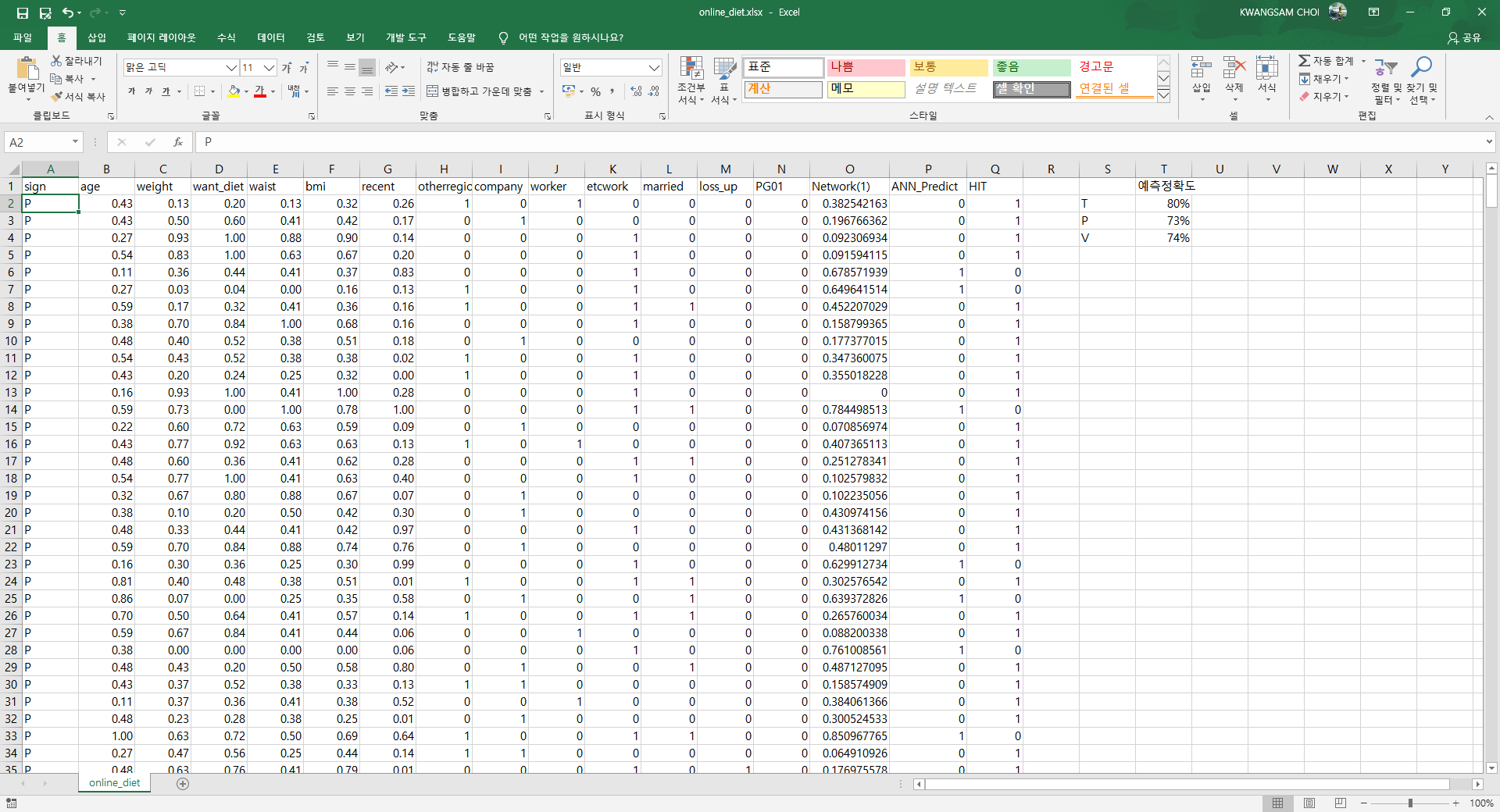
4. Apply Neural Network



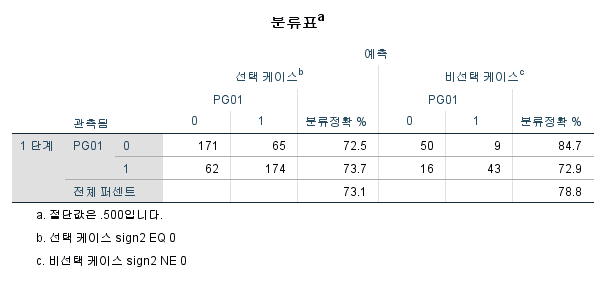


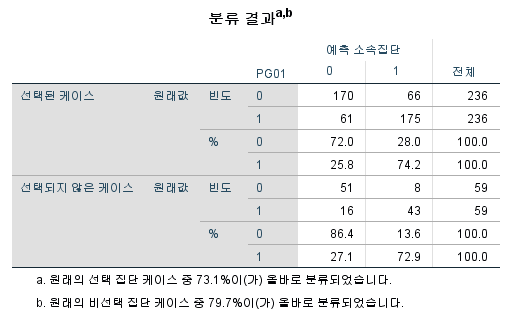
이렇게 도출된 결과는 여러 모델 간 예측정확도를 비교하는데 있어 보다 쉽게 할 수 있도록 엑셀로 옮겨놓았다.

5. 모델 간 예측정확도 비교



엑셀로 옮긴 NeuroShell2의 값을 IF 함수를 이용하여 원래 값과 예측된 값이 서로 일치하는지 여부를 확인한 다음, AVERAGEIF 함수를 이용하여 인공신경망의 예측정확도를 확인해보았다. 그 결과 T가 원래 값과 일치할 확률은 80%, P가 원래 값과 일치할 확률은 73%, V가 원래 값과 일치할 확률은 74%로 나타났다.





인공신경망 모델 구축에 쓰인 것과 동일한 데이터를 SPSS를 통해 분석한 로지스틱 회귀모형의 예측값(테스트 셋: 73.1% / 검증용: 78.8%)과 다중판별분석 모형의 예측값(테스트 셋: 73.1% / 검증용: 79.7%)을 비교해보면 테스트 셋의 예측정확도는 인공신경망 예측모델의 정확도가 80%로 기존 예측모델 대비 대략 7% 더 정확한 값을 예측해내는 것을 확인할 수 있다. 다만, 검증용 데이터의 예측 결과에서는 기존 모델보다 약 4% 정도 낮은 정확도를 보였다. 이는 일반적으로 인공신경망 예측 모델에서는 천의 단위의 데이터를 사용하는데, 그에 절반 정도에 못 미치는 적은 양의 데이터를 사용한 탓으로 추정된다.

**II. 소스코드**

NeuroShell2를 통해 구축한 다이어트 전략제품 구매확률에 대한 인공신경망 예측모형의 소스코드는 다음과 같다.

/\* Insert this code into your C program to fire the C:\Users\최광삼\Desktop\diet\_neuro\diet\_neuro network \*/

/\* This code is designed to be simple and fast for porting to any machine \*/

/\* Therefore all code and weights are inline without looping or data storage \*/

/\* which might be harder to port between compilers. \*/

#include <math.h>

void Fire\_diet\_neuro(double \*inarray, double \*outarray)

{

double netsum;

double feature2[26];

/\* inarray[0] is age \*/

/\* inarray[1] is weight \*/

/\* inarray[2] is want\_diet \*/

/\* inarray[3] is waist \*/

/\* inarray[4] is bmi \*/

/\* inarray[5] is recent \*/

/\* inarray[6] is otherregion \*/

/\* inarray[7] is company \*/

/\* inarray[8] is worker \*/

/\* inarray[9] is etcwork \*/

/\* inarray[10] is married \*/

/\* inarray[11] is loss\_up \*/

/\* outarray[0] is PG01 \*/

if (inarray[0]<0) inarray[0] = 0;

if (inarray[0]>1) inarray[0] = 1;

inarray[0] = 2 \* inarray[0] -1;

if (inarray[1]<0) inarray[1] = 0;

if (inarray[1]>1) inarray[1] = 1;

inarray[1] = 2 \* inarray[1] -1;

if (inarray[2]<0) inarray[2] = 0;

if (inarray[2]>1) inarray[2] = 1;

inarray[2] = 2 \* inarray[2] -1;

if (inarray[3]<0) inarray[3] = 0;

if (inarray[3]>1) inarray[3] = 1;

inarray[3] = 2 \* inarray[3] -1;

if (inarray[4]<0) inarray[4] = 0;

if (inarray[4]>1) inarray[4] = 1;

inarray[4] = 2 \* inarray[4] -1;

if (inarray[5]<0) inarray[5] = 0;

if (inarray[5]>1) inarray[5] = 1;

inarray[5] = 2 \* inarray[5] -1;

if (inarray[6]<0) inarray[6] = 0;

if (inarray[6]>1) inarray[6] = 1;

inarray[6] = 2 \* inarray[6] -1;

if (inarray[7]<0) inarray[7] = 0;

if (inarray[7]>1) inarray[7] = 1;

inarray[7] = 2 \* inarray[7] -1;

if (inarray[8]<0) inarray[8] = 0;

if (inarray[8]>1) inarray[8] = 1;

inarray[8] = 2 \* inarray[8] -1;

if (inarray[9]<0) inarray[9] = 0;

if (inarray[9]>1) inarray[9] = 1;

inarray[9] = 2 \* inarray[9] -1;

if (inarray[10]<0) inarray[10] = 0;

if (inarray[10]>1) inarray[10] = 1;

inarray[10] = 2 \* inarray[10] -1;

if (inarray[11]<0) inarray[11] = 0;

if (inarray[11]>1) inarray[11] = 1;

inarray[11] = 2 \* inarray[11] -1;

netsum = 0.8324342;

netsum += inarray[0] \* -1.009404;

netsum += inarray[1] \* 8.799966E-02;

netsum += inarray[2] \* 0.5036277;

netsum += inarray[3] \* -0.5942656;

netsum += inarray[4] \* 1.854447;

netsum += inarray[5] \* 0.0270042;

netsum += inarray[6] \* -0.889159;

netsum += inarray[7] \* 0.1235366;

netsum += inarray[8] \* -0.9918333;

netsum += inarray[9] \* 0.3138816;

netsum += inarray[10] \* -1.383764;

netsum += inarray[11] \* -0.2634165;

feature2[0] = 1 / (1 + exp(-netsum));

netsum = 0.4849023;

netsum += inarray[0] \* 0.5333992;

netsum += inarray[1] \* 0.6506463;

netsum += inarray[2] \* -0.2561222;

netsum += inarray[3] \* -0.3378005;

netsum += inarray[4] \* -0.4980838;

netsum += inarray[5] \* 0.4514987;

netsum += inarray[6] \* -0.5573189;

netsum += inarray[7] \* 0.2144111;

netsum += inarray[8] \* -0.3449552;

netsum += inarray[9] \* 0.2047686;

netsum += inarray[10] \* -0.3850221;

netsum += inarray[11] \* -0.8287823;

feature2[1] = 1 / (1 + exp(-netsum));

netsum = -0.2234271;

netsum += inarray[0] \* -0.1390942;

netsum += inarray[1] \* 0.7828778;

netsum += inarray[2] \* -8.312932E-02;

netsum += inarray[3] \* 0.1153264;

netsum += inarray[4] \* -1.095473;

netsum += inarray[5] \* 4.919062E-03;

netsum += inarray[6] \* 0.5546731;

netsum += inarray[7] \* -0.839888;

netsum += inarray[8] \* 0.1531019;

netsum += inarray[9] \* 0.7516379;

netsum += inarray[10] \* 0.1411174;

netsum += inarray[11] \* 0.2492486;

feature2[2] = 1 / (1 + exp(-netsum));

netsum = 0.5727242;

netsum += inarray[0] \* -5.715838E-02;

netsum += inarray[1] \* 0.5346195;

netsum += inarray[2] \* -1.06464;

netsum += inarray[3] \* 0.4138955;

netsum += inarray[4] \* -0.4141825;

netsum += inarray[5] \* -0.5839589;

netsum += inarray[6] \* 0.9198521;

netsum += inarray[7] \* 0.3310749;

netsum += inarray[8] \* -0.7664384;

netsum += inarray[9] \* -0.192076;

netsum += inarray[10] \* -0.8611677;

netsum += inarray[11] \* 2.276793E-02;

feature2[3] = 1 / (1 + exp(-netsum));

netsum = 0.4905791;

netsum += inarray[0] \* -0.5305395;

netsum += inarray[1] \* 0.1391639;

netsum += inarray[2] \* 7.743853E-02;

netsum += inarray[3] \* 0.8037063;

netsum += inarray[4] \* -3.929911E-02;

netsum += inarray[5] \* -0.4622524;

netsum += inarray[6] \* -0.2111205;

netsum += inarray[7] \* -0.4191473;

netsum += inarray[8] \* -0.5603592;

netsum += inarray[9] \* 0.4870619;

netsum += inarray[10] \* 0.4682886;

netsum += inarray[11] \* -0.5968947;

feature2[4] = 1 / (1 + exp(-netsum));

netsum = -0.14504;

netsum += inarray[0] \* 0.3290345;

netsum += inarray[1] \* -1.130337;

netsum += inarray[2] \* 0.773141;

netsum += inarray[3] \* -0.8583223;

netsum += inarray[4] \* -0.1737937;

netsum += inarray[5] \* -0.5142117;

netsum += inarray[6] \* -0.8974462;

netsum += inarray[7] \* 0.2485329;

netsum += inarray[8] \* 0.2836421;

netsum += inarray[9] \* 0.1088973;

netsum += inarray[10] \* 0.5100356;

netsum += inarray[11] \* -0.0700234;

feature2[5] = 1 / (1 + exp(-netsum));

netsum = 0.4014792;

netsum += inarray[0] \* -3.214488E-04;

netsum += inarray[1] \* -0.3209868;

netsum += inarray[2] \* 0.3774504;

netsum += inarray[3] \* -0.5361587;

netsum += inarray[4] \* 0.897836;

netsum += inarray[5] \* 0.2097916;

netsum += inarray[6] \* 0.1892741;

netsum += inarray[7] \* -0.1031997;

netsum += inarray[8] \* -0.5654744;

netsum += inarray[9] \* -0.1485947;

netsum += inarray[10] \* -0.2449291;

netsum += inarray[11] \* -0.5070183;

feature2[6] = 1 / (1 + exp(-netsum));

netsum = 0.6120967;

netsum += inarray[0] \* 0.7227162;

netsum += inarray[1] \* -1.792789;

netsum += inarray[2] \* -0.6169202;

netsum += inarray[3] \* -0.3221763;

netsum += inarray[4] \* 1.675468;

netsum += inarray[5] \* -0.6463695;

netsum += inarray[6] \* -0.9010657;

netsum += inarray[7] \* 1.644499;

netsum += inarray[8] \* -0.8643335;

netsum += inarray[9] \* -0.6715951;

netsum += inarray[10] \* 2.100054E-02;

netsum += inarray[11] \* -1.269114;

feature2[7] = 1 / (1 + exp(-netsum));

netsum = 0.1917884;

netsum += inarray[0] \* -9.855594E-02;

netsum += inarray[1] \* 0.4144386;

netsum += inarray[2] \* -1.798076;

netsum += inarray[3] \* 0.3405814;

netsum += inarray[4] \* -1.400771;

netsum += inarray[5] \* -1.120993;

netsum += inarray[6] \* -0.6953164;

netsum += inarray[7] \* 0.8762048;

netsum += inarray[8] \* 4.305815E-02;

netsum += inarray[9] \* -1.242265;

netsum += inarray[10] \* -0.8967844;

netsum += inarray[11] \* 0.4806531;

feature2[8] = 1 / (1 + exp(-netsum));

netsum = 0.6534801;

netsum += inarray[0] \* 9.572156E-02;

netsum += inarray[1] \* -0.9381526;

netsum += inarray[2] \* -0.5185987;

netsum += inarray[3] \* -0.3688881;

netsum += inarray[4] \* 9.120544E-02;

netsum += inarray[5] \* -0.2451064;

netsum += inarray[6] \* 3.656542E-02;

netsum += inarray[7] \* 0.2078328;

netsum += inarray[8] \* -0.2360475;

netsum += inarray[9] \* -0.3547889;

netsum += inarray[10] \* 0.3024404;

netsum += inarray[11] \* -0.7145273;

feature2[9] = 1 / (1 + exp(-netsum));

netsum = -2.420769E-02;

netsum += inarray[0] \* 1.365065;

netsum += inarray[1] \* 1.541498;

netsum += inarray[2] \* -2.885085;

netsum += inarray[3] \* -0.2214469;

netsum += inarray[4] \* -0.5453129;

netsum += inarray[5] \* 2.71401;

netsum += inarray[6] \* -0.3110048;

netsum += inarray[7] \* 0.1049586;

netsum += inarray[8] \* -0.9434364;

netsum += inarray[9] \* 3.463347E-02;

netsum += inarray[10] \* 1.593642E-02;

netsum += inarray[11] \* -0.9843396;

feature2[10] = 1 / (1 + exp(-netsum));

netsum = 0.527099;

netsum += inarray[0] \* 0.3246855;

netsum += inarray[1] \* 0.1572891;

netsum += inarray[2] \* -0.2083255;

netsum += inarray[3] \* 0.151337;

netsum += inarray[4] \* -0.2822335;

netsum += inarray[5] \* -0.271508;

netsum += inarray[6] \* 0.135406;

netsum += inarray[7] \* 0.1410882;

netsum += inarray[8] \* -0.6572818;

netsum += inarray[9] \* 0.2018896;

netsum += inarray[10] \* -0.7795432;

netsum += inarray[11] \* -0.3825276;

feature2[11] = 1 / (1 + exp(-netsum));

netsum = 0.5903665;

netsum += inarray[0] \* 0.2076311;

netsum += inarray[1] \* -0.965389;

netsum += inarray[2] \* -0.3691564;

netsum += inarray[3] \* -0.1799534;

netsum += inarray[4] \* 0.3315587;

netsum += inarray[5] \* -0.2117538;

netsum += inarray[6] \* 0.1847757;

netsum += inarray[7] \* 0.4608989;

netsum += inarray[8] \* -0.3534614;

netsum += inarray[9] \* -0.0390228;

netsum += inarray[10] \* 0.1050978;

netsum += inarray[11] \* -0.8285341;

feature2[12] = 1 / (1 + exp(-netsum));

netsum = 0.1344881;

netsum += inarray[0] \* -0.1601008;

netsum += inarray[1] \* 0.5971546;

netsum += inarray[2] \* 0.1504849;

netsum += inarray[3] \* 0.2482371;

netsum += inarray[4] \* -0.3369412;

netsum += inarray[5] \* -6.436785E-02;

netsum += inarray[6] \* -0.2145924;

netsum += inarray[7] \* -0.4145341;

netsum += inarray[8] \* -8.335336E-02;

netsum += inarray[9] \* 0.3662711;

netsum += inarray[10] \* -0.182315;

netsum += inarray[11] \* -3.553776E-02;

feature2[13] = 1 / (1 + exp(-netsum));

netsum = 0.2076916;

netsum += inarray[0] \* 0.19953;

netsum += inarray[1] \* -0.1908853;

netsum += inarray[2] \* -0.1726804;

netsum += inarray[3] \* -0.2001367;

netsum += inarray[4] \* -0.2643026;

netsum += inarray[5] \* -4.083323E-02;

netsum += inarray[6] \* -7.755315E-02;

netsum += inarray[7] \* 0.1984065;

netsum += inarray[8] \* -0.2868846;

netsum += inarray[9] \* -0.1563479;

netsum += inarray[10] \* -0.2193668;

netsum += inarray[11] \* -0.5171931;

feature2[14] = 1 / (1 + exp(-netsum));

netsum = -3.886807E-02;

netsum += inarray[0] \* 0.1563634;

netsum += inarray[1] \* -0.3006245;

netsum += inarray[2] \* -3.427394E-03;

netsum += inarray[3] \* -0.1526299;

netsum += inarray[4] \* -3.778153E-02;

netsum += inarray[5] \* 0.1109331;

netsum += inarray[6] \* -0.3885013;

netsum += inarray[7] \* -0.1534872;

netsum += inarray[8] \* -0.3036089;

netsum += inarray[9] \* -0.1141069;

netsum += inarray[10] \* 0.1069974;

netsum += inarray[11] \* -0.2405679;

feature2[15] = 1 / (1 + exp(-netsum));

netsum = 7.858755E-02;

netsum += inarray[0] \* 0.2799198;

netsum += inarray[1] \* -0.2822836;

netsum += inarray[2] \* 0.1261555;

netsum += inarray[3] \* -0.1042713;

netsum += inarray[4] \* 1.069868;

netsum += inarray[5] \* -0.1448635;

netsum += inarray[6] \* -3.187494E-02;

netsum += inarray[7] \* 0.1601031;

netsum += inarray[8] \* -0.3909382;

netsum += inarray[9] \* -0.5122446;

netsum += inarray[10] \* -0.8024101;

netsum += inarray[11] \* -0.2227132;

feature2[16] = 1 / (1 + exp(-netsum));

netsum = 0.2611769;

netsum += inarray[0] \* 0.2513898;

netsum += inarray[1] \* 0.192657;

netsum += inarray[2] \* 4.398692E-03;

netsum += inarray[3] \* -7.913022E-02;

netsum += inarray[4] \* -0.2365197;

netsum += inarray[5] \* -0.1428106;

netsum += inarray[6] \* -0.3280011;

netsum += inarray[7] \* 6.429266E-02;

netsum += inarray[8] \* -0.6301655;

netsum += inarray[9] \* -0.1209942;

netsum += inarray[10] \* -5.428226E-02;

netsum += inarray[11] \* -0.3318071;

feature2[17] = 1 / (1 + exp(-netsum));

netsum = 0.1297862;

netsum += inarray[0] \* -6.81124E-03;

netsum += inarray[1] \* 1.030368E-02;

netsum += inarray[2] \* 5.093158E-03;

netsum += inarray[3] \* -0.2980518;

netsum += inarray[4] \* 0.2045972;

netsum += inarray[5] \* -0.3254778;

netsum += inarray[6] \* -0.1252403;

netsum += inarray[7] \* -0.1464316;

netsum += inarray[8] \* -0.1691576;

netsum += inarray[9] \* 0.1496561;

netsum += inarray[10] \* -0.1653157;

netsum += inarray[11] \* -0.2160503;

feature2[18] = 1 / (1 + exp(-netsum));

netsum = 0.0902269;

netsum += inarray[0] \* -0.1984581;

netsum += inarray[1] \* 0.3987583;

netsum += inarray[2] \* -0.2961904;

netsum += inarray[3] \* 0.23888;

netsum += inarray[4] \* -5.782365E-02;

netsum += inarray[5] \* -0.1687429;

netsum += inarray[6] \* -0.2130049;

netsum += inarray[7] \* -0.1841524;

netsum += inarray[8] \* -0.2869512;

netsum += inarray[9] \* 0.2608287;

netsum += inarray[10] \* -0.1883301;

netsum += inarray[11] \* -0.3253576;

feature2[19] = 1 / (1 + exp(-netsum));

netsum = 0.6474316;

netsum += inarray[0] \* -7.894548E-02;

netsum += inarray[1] \* -9.539741E-02;

netsum += inarray[2] \* 0.1974181;

netsum += inarray[3] \* -1.492105E-02;

netsum += inarray[4] \* -5.598769E-02;

netsum += inarray[5] \* 5.294666E-02;

netsum += inarray[6] \* -0.119231;

netsum += inarray[7] \* 4.824624E-02;

netsum += inarray[8] \* -0.2782066;

netsum += inarray[9] \* 5.176775E-02;

netsum += inarray[10] \* -0.4815352;

netsum += inarray[11] \* -0.460862;

feature2[20] = 1 / (1 + exp(-netsum));

netsum = 0.3565248;

netsum += inarray[0] \* -0.2422504;

netsum += inarray[1] \* -0.5816256;

netsum += inarray[2] \* 3.228551E-02;

netsum += inarray[3] \* -0.1261766;

netsum += inarray[4] \* 0.3214397;

netsum += inarray[5] \* 0.1249602;

netsum += inarray[6] \* -8.941265E-02;

netsum += inarray[7] \* 5.320761E-02;

netsum += inarray[8] \* -0.2258381;

netsum += inarray[9] \* -7.036582E-02;

netsum += inarray[10] \* -0.3458121;

netsum += inarray[11] \* -0.2148289;

feature2[21] = 1 / (1 + exp(-netsum));

netsum = 0.2308322;

netsum += inarray[0] \* -0.1049895;

netsum += inarray[1] \* 0.8421545;

netsum += inarray[2] \* -0.8162465;

netsum += inarray[3] \* 0.6611323;

netsum += inarray[4] \* -0.1352762;

netsum += inarray[5] \* -6.514258E-02;

netsum += inarray[6] \* 0.5051051;

netsum += inarray[7] \* -4.608627E-02;

netsum += inarray[8] \* -0.4645218;

netsum += inarray[9] \* 0.1502979;

netsum += inarray[10] \* -0.3476329;

netsum += inarray[11] \* -0.4053115;

feature2[22] = 1 / (1 + exp(-netsum));

netsum = 0.2196469;

netsum += inarray[0] \* -0.6880457;

netsum += inarray[1] \* -0.4766956;

netsum += inarray[2] \* 0.3935314;

netsum += inarray[3] \* -0.369472;

netsum += inarray[4] \* 0.2484043;

netsum += inarray[5] \* 0.2731576;

netsum += inarray[6] \* -0.2080854;

netsum += inarray[7] \* -0.1443658;

netsum += inarray[8] \* -0.6488575;

netsum += inarray[9] \* -7.509696E-02;

netsum += inarray[10] \* -0.7618769;

netsum += inarray[11] \* -0.4757225;

feature2[23] = 1 / (1 + exp(-netsum));

netsum = -2.097254E-02;

netsum += inarray[0] \* 0.1919984;

netsum += inarray[1] \* 2.790313E-02;

netsum += inarray[2] \* -0.3006918;

netsum += inarray[3] \* -0.2228446;

netsum += inarray[4] \* -1.392037E-02;

netsum += inarray[5] \* -0.3496368;

netsum += inarray[6] \* -0.1307742;

netsum += inarray[7] \* 6.666344E-02;

netsum += inarray[8] \* -0.2486103;

netsum += inarray[9] \* -8.076184E-03;

netsum += inarray[10] \* 8.630705E-02;

netsum += inarray[11] \* -8.209713E-03;

feature2[24] = 1 / (1 + exp(-netsum));

netsum = 0.425753;

netsum += inarray[0] \* 0.3018224;

netsum += inarray[1] \* -0.1246663;

netsum += inarray[2] \* 1.2392;

netsum += inarray[3] \* -0.4717711;

netsum += inarray[4] \* 1.228852;

netsum += inarray[5] \* 0.5026451;

netsum += inarray[6] \* 0.8155102;

netsum += inarray[7] \* -0.6944387;

netsum += inarray[8] \* -0.1111507;

netsum += inarray[9] \* 0.6087634;

netsum += inarray[10] \* 0.5001101;

netsum += inarray[11] \* -0.4904746;

feature2[25] = 1 / (1 + exp(-netsum));

netsum = 0.1442987;

netsum += feature2[0] \* -1.796453;

netsum += feature2[1] \* 0.7581317;

netsum += feature2[2] \* 0.9438611;

netsum += feature2[3] \* 1.160583;

netsum += feature2[4] \* 1.012153;

netsum += feature2[5] \* -0.950834;

netsum += feature2[6] \* -0.4675803;

netsum += feature2[7] \* -2.55208;

netsum += feature2[8] \* 1.841948;

netsum += feature2[9] \* -0.8615507;

netsum += feature2[10] \* 2.747546;

netsum += feature2[11] \* 0.5440722;

netsum += feature2[12] \* -0.787976;

netsum += feature2[13] \* 0.4287277;

netsum += feature2[14] \* -5.252603E-02;

netsum += feature2[15] \* -9.509154E-02;

netsum += feature2[16] \* -0.5382935;

netsum += feature2[17] \* 0.2429713;

netsum += feature2[18] \* 7.037476E-02;

netsum += feature2[19] \* 0.2937031;

netsum += feature2[20] \* -3.157638E-02;

netsum += feature2[21] \* -0.3222044;

netsum += feature2[22] \* 0.7372624;

netsum += feature2[23] \* -0.6344143;

netsum += feature2[24] \* 5.070869E-02;

netsum += feature2[25] \* -1.006118;

outarray[0] = 1 / (1 + exp(-netsum));

outarray[0] = (outarray[0] - .1) / .8 ;

if (outarray[0]<0) outarray[0] = 0;

if (outarray[0]>1) outarray[0] = 1;

}