Neural Network Learning

Here we look at the practical considerations for constructing artificial neural networks:

(1) All training data has to be numerical, even categorical data has to be mapped into numerical values (sub-symbolic learner)

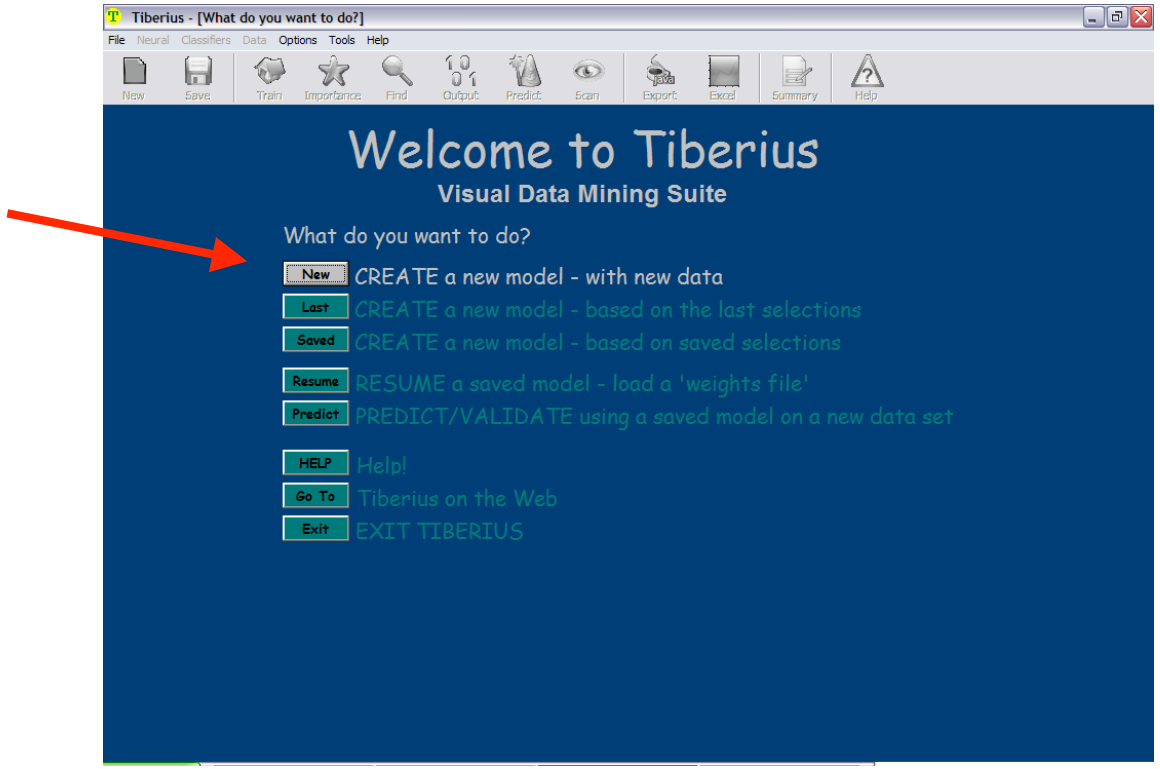
(2) It is customary to normalize the data into the interval [0,1], or something close to it.

(3) We need to pick a topology for the network
- Do we need a hidden layer?
- If so, how many nodes in the hidden layer?

(4) We need to pick a learning rate.

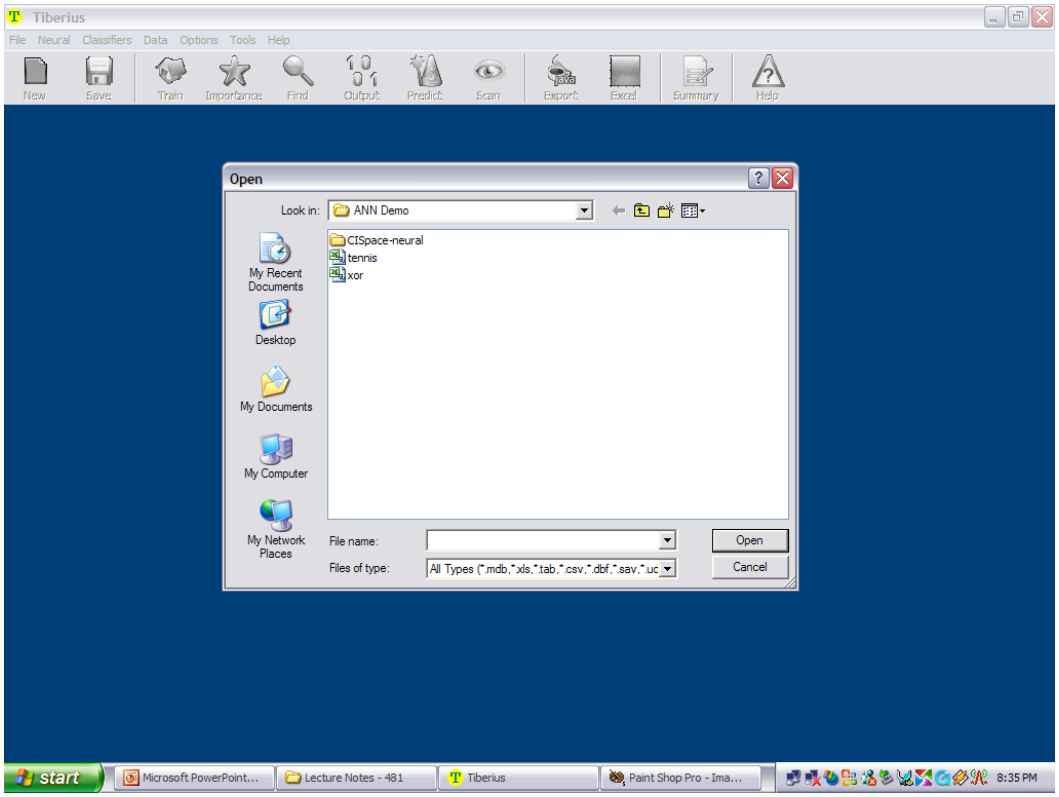
(5) We need to pick a convergence criterion that will tell us whether we learned the concept/training examples successfully.

Tiberius Data Mining Suite



Create a new neural network.

Tiberius Data Mining Suite



Select a CSV file for training. NOTE: ignore the tip dialog box.

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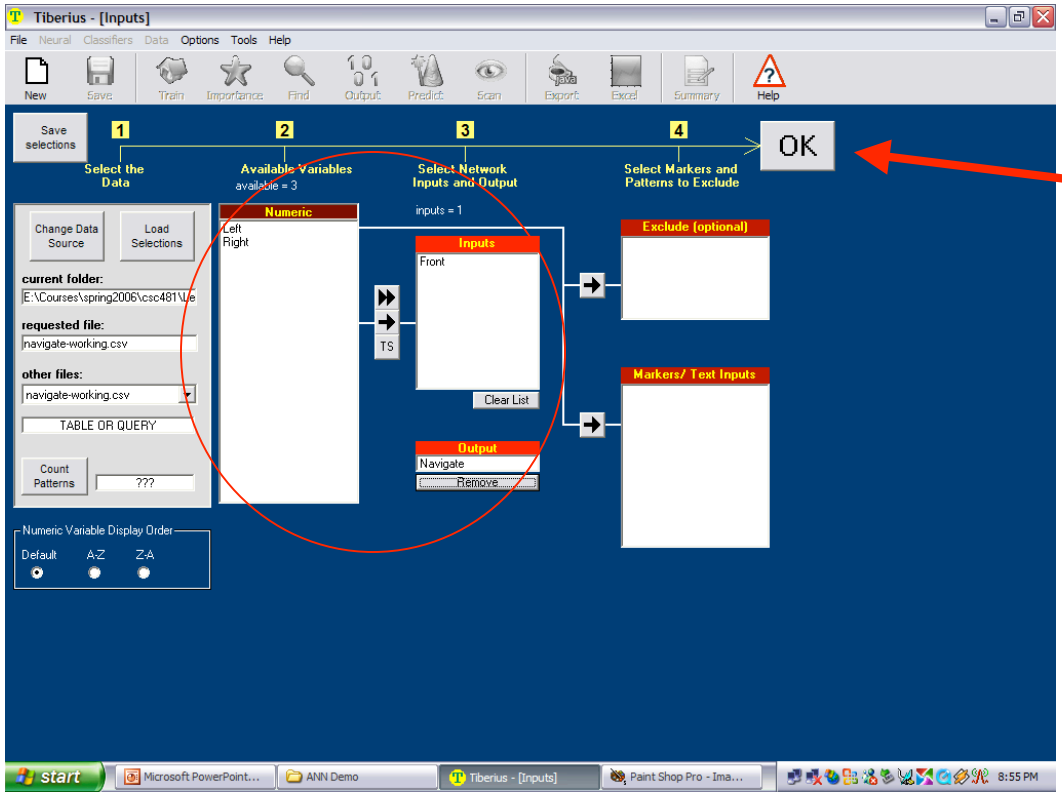

Hit OK when you are done.

Select the neural network inputs and output; the inputs are given by your independent attributes, the output is your target attribute.

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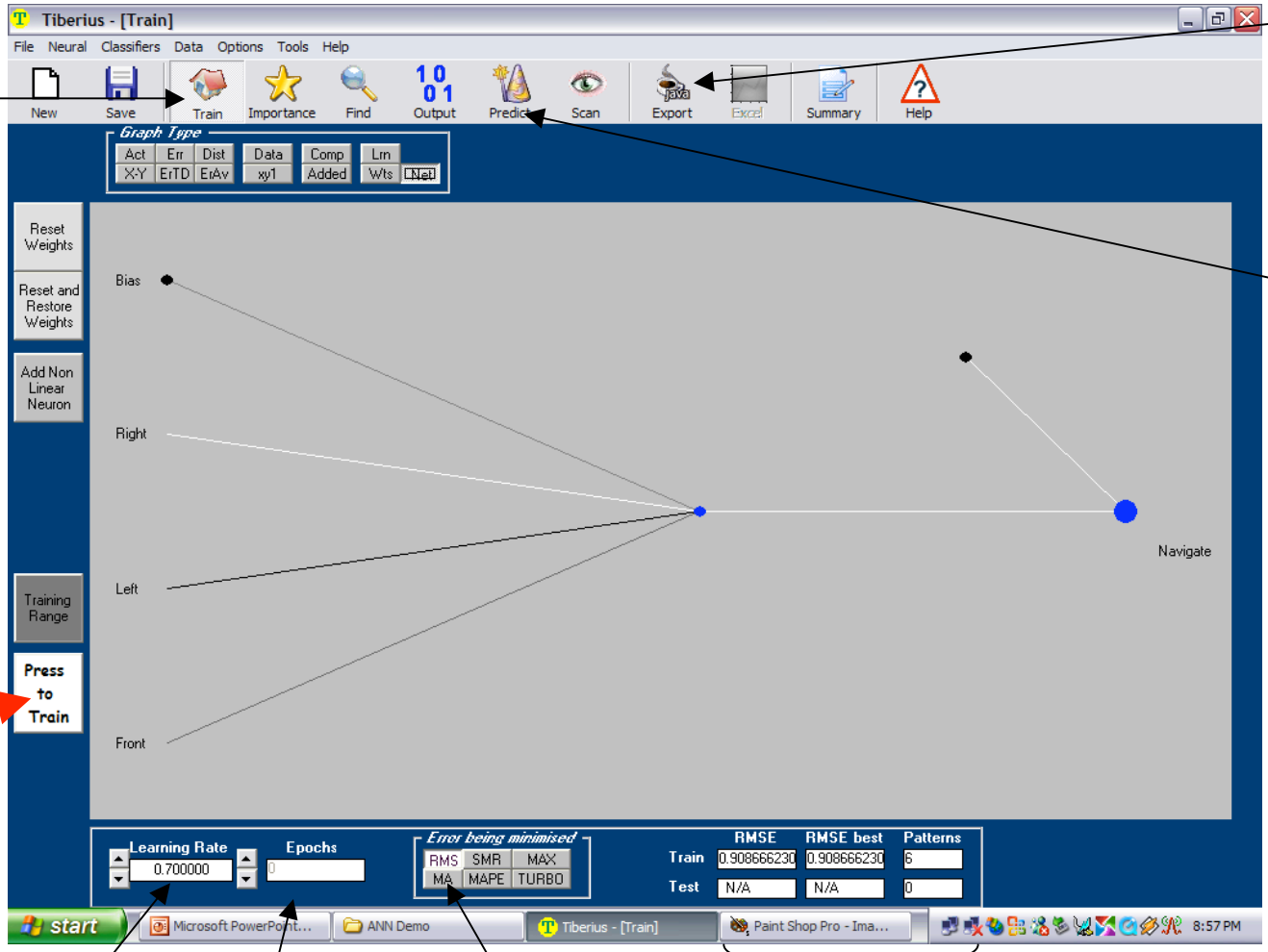

Training Window

Generate Code Window

Check Results Window

Start Training

Learning Rate

Training Iterations

Error

Training Status

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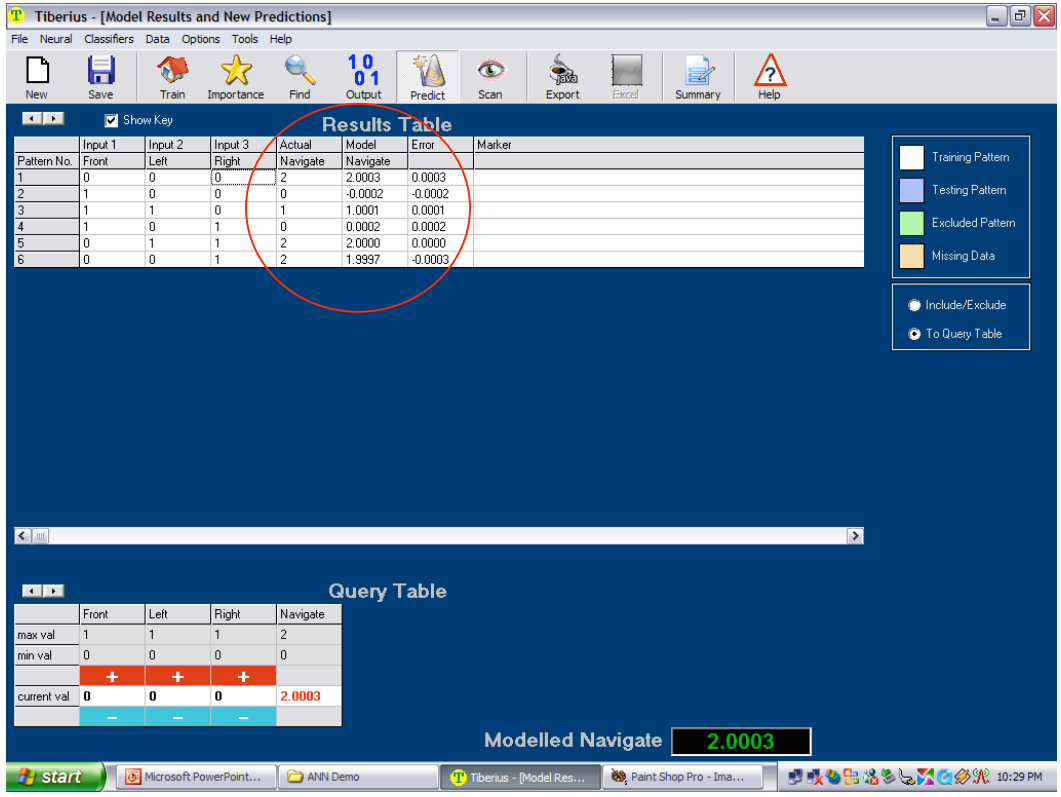

	Input 1	Input 2	Input 3	Actual	Model	Error	Marker
Pattern No.	Front	Left	Right	Navigate	Navigate		
1	0	0	0	2	2.0003	0.0003	
2	1	0	0	0	-0.0002	-0.0002	
3	1	1	0	1	1.0001	0.0001	
4	1	0	1	0	0.0002	0.0002	
5	0	1	1	2	2.0000	0.0000	
6	0	0	1	2	1.9997	-0.0003	

	Front	Left	Right	Navigate
max val	1	1	1	2
min val	0	0	0	0
current val	0	0	0	2.0003

Validating the model: Comparing the target values computed by the neural network with the target attribute values given in the training data.

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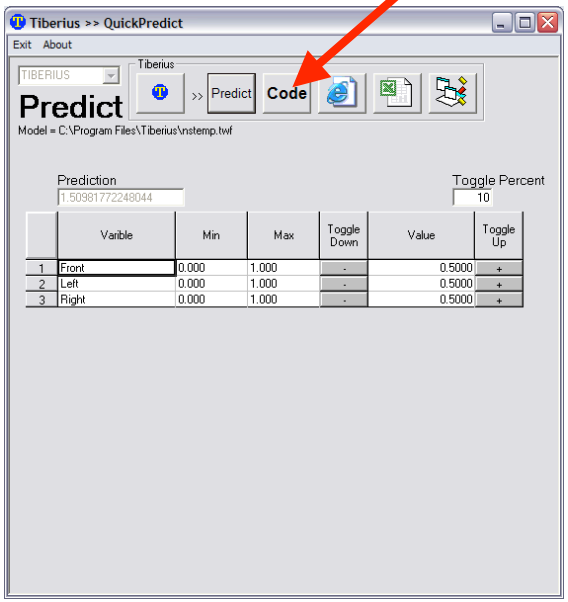

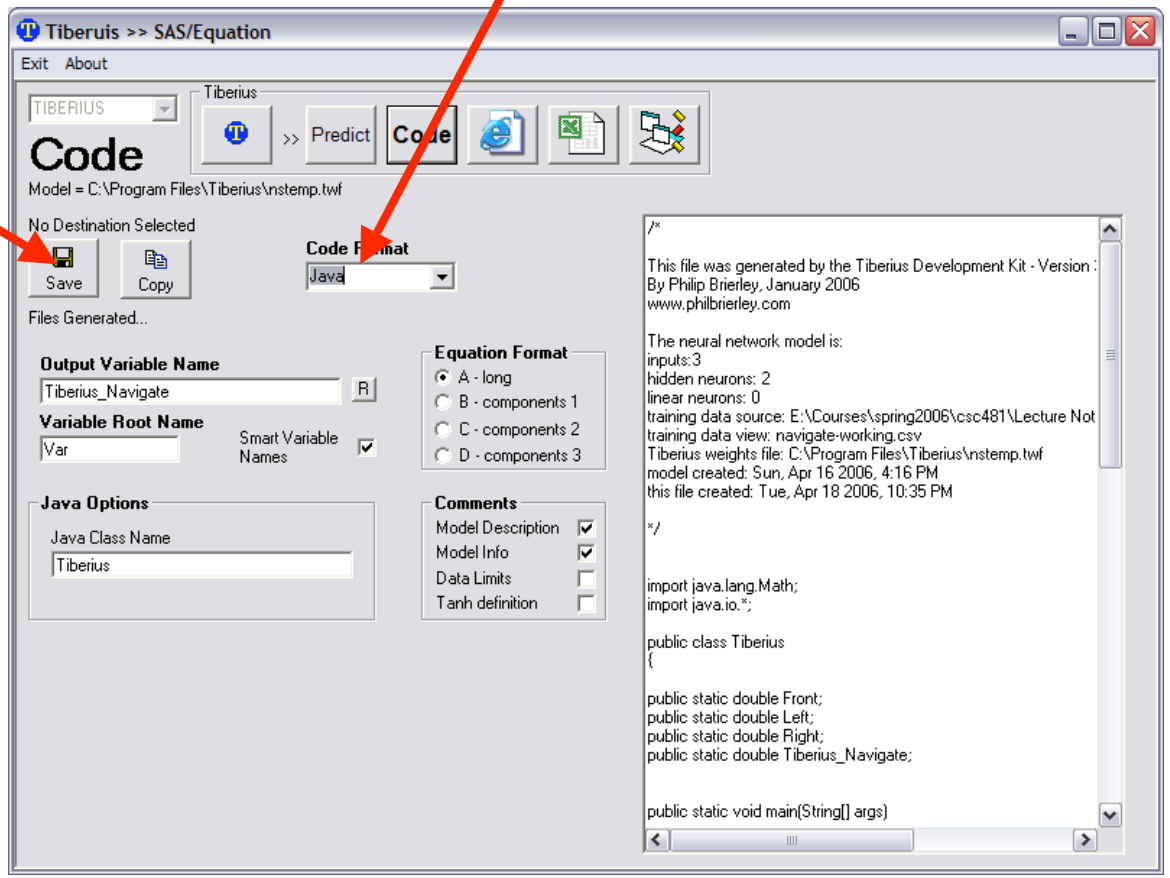

Tiberius Data Mining Suite

Done!

The Generated Java Code

```
public class Tiberius
{

   public static double Left;
   public static double Right;
   public static double Tiberius_Navigate;

   public static void calcNet()
   {
      Tiberius_Navigate =
      ((((+0.253747737130866 *
         (((Front * (-3.34737363256178)) + 1.67368681628089)
          + ((Left * (-0.23827360982432)) + 0.11913680491216)
          + ((Right * (-1.81516094934551E-02)) + 9.07580474672754E-03)
          - 0.134088362248703)
         +0.646454845854852 *
         (myTanh(((Front * (-2.84977887744496)) + 1.42488943872248)
               + ((Left * (2.37752505197836)) - 1.18876252598918)
               + ((Right * (3.39382279056324E-02)) - 1.69691139528162E-02)
               + 1.2472225227062
               ))
         -4.03005224703632E-03)/2) + 0.5) * 2);
   }

   public static double myTanh(double x)
   {
      if (x > 20)
         return 1;
      else if (x < -20)
         return -1;
      else
      {
         double a = Math.exp(x);
         double b = Math.exp(-x);
         return (a-b)/(a+b);
      }
   }

}
```

The NN Adapter

```
// Tiberius Neural Network Adapter for QLearner

class DecisionModule
{
    // attribute values

    // values for Left
    public static final int lclear = 0;
    public static final int lblocked = 1;
    // values for Right
    public static final int rclear = 0;
    public static final int rblocked = 1;

    // values for Front
    public static final int fclear = 0;
    public static final int fblocked = 1;

   // values for Navigate
    public static final int left = 0;
    public static final int right = 1;
    public static final int walk = 2;

    private static final double epsilon = 0.001;
```

```
// decision function

    public static int decide(int Left,int Right,int Front) {
                    Tiberius.Left = Left;
                    Tiberius.Right = Right;
                    Tiberius.Front = Front;
                    Tiberius.calcNet();

                    // NOTE: the following code is highly dependent on the
                    // value assignment for Navigate

                    double retVal = Tiberius.Tiberius_Navigate;

                    if (retVal > 2 - epsilon)
                        return walk;
                    else if (retVal > 1 - epsilon)
                        return right;
                    else if (retVal > 0 - epsilon)
                        return left;
                    else
                        return -1;
    }
}
```