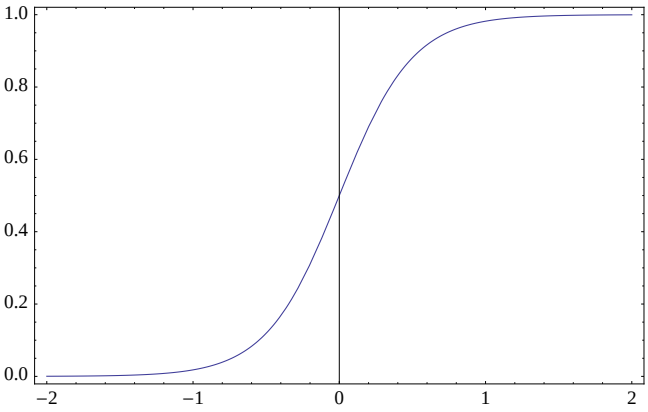
In[1]:=
```
ClearAll[x, s]
s[x_] := 1 / (1 + E^(-4 * x)); D[s[x], x]
Plot[s[x], {x, -2, 2}, Frame → True]
```

Out[2]=
$$\frac{4\, e^{-4x}}{\left(1 + e^{-4x}\right)^2}$$

Out[3]=



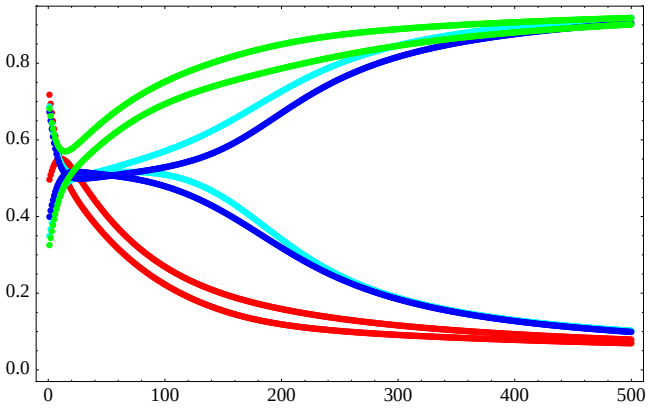
```
alpha = 0.1
x = {1, 0}; (* example input *)
t = {1, 2};  (* example output *)

initWeights[training0_, hiddenSize0_] := Module[{training = training0,
   hiddenSize = hiddenSize0, firstCase, x, t, inSize, outSize, weightRange},
  firstCase = training[[1]];
  x = firstCase[[1]];
  t = firstCase[[2]];
  inSize = Length[x];
  outSize = Length[t];
  weightRange = 1 / Sqrt[2];
  v = RandomReal[{-weightRange, weightRange}, {inSize + 1, hiddenSize}];
  w = RandomReal[{-weightRange, weightRange}, {hiddenSize + 1, outSize}];
 ]

(* forward only *)
forward[x0_] := Module[{x = x0, layer1, layer2},
  x = Prepend[x, -1];
  layer1 = x.v;
  layer1 = Map[s, layer1] ;
  layer1 = Prepend[layer1, -1];
  layer2 = layer1.w;
  layer2 = Map[s, layer2];
  layer2]

(* adjust weights *)
adjust[x0_, t0_] := Module[{x = x0, t = t0, layer1, layer2, delta1, delta2, y},
  (* forward *)
  x = Prepend[x, -1];
  layer1 = x.v;
  layer1 = Map[s, layer1] ;
  layer1 = Prepend[layer1, -1];
  layer2 = layer1.w;
  layer2 = Map[s, layer2];
  y = layer2;
  (* backward.  Uses layer1 and y data *)
  delta2 = (t - y) y (1 - y);
  delta1 = ( layer1 (1 - layer1)) ( delta2. Transpose[w]);
  w = w + alpha * Transpose[{layer1}] . {delta2};
  delta1 = Drop[delta1, 1];
  v = v + alpha * Transpose[{x}] . {delta1};
  EuclideanDistance[y, t];
  y
 ]
```

Out[4]= 0.1

In[10]:=
```
training = {
   {{0, 0}, {0, 0}},
   {{0, 1}, {0, 1}},
   {{1, 0}, {1, 0}},
   {{1, 1}, {1, 1}}}
initWeights[training, 3];
z = Table[Flatten[Map[Apply[adjust, #] &,  training]], {i, 1, 500}];
ListPlot[Transpose[z], Frame → True,
 PlotStyle → {Red, Red, Cyan, Cyan, Blue, Blue, Green, Green}]
Map[forward[First[#]] &, training]
forward[{1, 1}]
```

Out[10]= {{{0, 0}, {0, 0}}, {{0, 1}, {0, 1}}, {{1, 0}, {1, 0}}, {{1, 1}, {1, 1}}}

Out[13]=

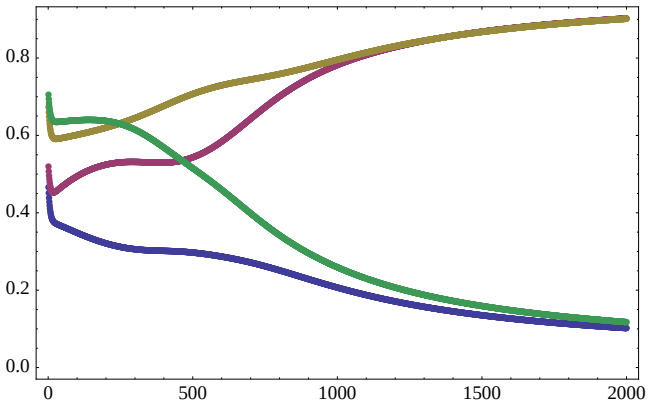


Out[14]= {{0.0692314, 0.0788891}, {0.102234, 0.918978}, {0.905455, 0.0987968}, {0.918699, 0.902009}}

Out[15]= {0.918699, 0.902009}

In[25]:=
```
training = {
   {{0, 0}, {0}},
   {{0, 1}, {1}},
   {{1, 0}, {1}},
   {{1, 1}, {0}}};
initWeights[training, 2];
z = Table[Flatten[Map[Apply[adjust, #] &,  training]], {i, 1, 2000}];
ListPlot[Transpose[z], Frame → True]
```

Out[28]=



In[29]:=
```
Plot3D[forward[{x, y}], {x, 0, 1}, {y, 0, 1}]
```

Out[29]=