MyNeuralNetworkStuff

```
InitializeNetwork[layerarchitecture_] :=
 Module[{w, d, x, L},
  L = Length[layerarchitecture];
  For[i = 0, i < L, i++,
   d[i] = layerarchitecture[[i + 1]];
  ];
  For[l = 1, l ≤ L, l++,
   For[j = 1, j ≤ d[l], j++,
     For[i = 0, i ≤ d[l - 1], i++,
       (w[l][i][j]) = RandomReal[{-1, 1}];
      ];
    ];
  ];
  {w, d, L - 1, x}]

ComputeOutput[{w_, d_, L_, x_}, inputs_] :=
 Module[{},
  x[0][0] = 1;
  For[j = 1, j ≤ d[0], j++,
   x[0][j] = inputs[[j]];
  ];
  For[l = 1, l ≤ L, l++,
   x[l][0] = 1;
   For[j = 1, j ≤ d[l], j++,
    x[l][j] = Tanh[Sum[w[l][i][j] * x[l - 1][i], {i, 0, d[l - 1]}]];
   ];
  ];
  Table[x[L][j], {j, 1, d[L]}]
 ]
```

```
Learn[{w_, d_, L_, x_}, inputs_, outputs_, numSamples_, numIter_, alpha_] :=
 Module[{delta, y, k},
  For[iter = 0, iter < numIter, iter++,
   k = RandomInteger[{1, numSamples}];
   ComputeOutput[{w, d, L, x}, inputs[[(k - 1) * (d[0]) + 1 ;; ((k) * (d[0]))]]];
   y[0] = 1;
   For[j = 1, j ≤ d[L], j++,
    y[j] = outputs[[(k - 1) * (d[L]) + j]];
   ];
   For[j = 1, j ≤ d[L], j++,
    (delta[L][j]) = (1 - (x[L][j])^2) * (x[L][j] - y[j]);
   ];
   For[l = L, l ≥ 1, l--,
    For[i = 1, i ≤ d[l - 1], i++,
      (delta[l - 1][i]) =
       (1 - (x[l - 1][i])^2) * Sum[((w[l][i][j]) * (delta[l][j])), {j, 1, d[l]}];
     ];
   ];
   For[l = 1, l ≤ L, l++,
    For[j = 1, j ≤ d[l], j++,
      For[i = 0, i ≤ d[l - 1], i++,
       (w[l][i][j]) = (w[l][i][j]) - alpha * (x[l - 1][i]) * (delta[l][j]);
       ];
      ];
    ];
  ];
  {w, d, L, x}
 ]
```

```
titi[1][2][4] = RandomReal[{1, 3}]
```

```
1.21137
```

Usage

Xor problem, centered on (0,0)

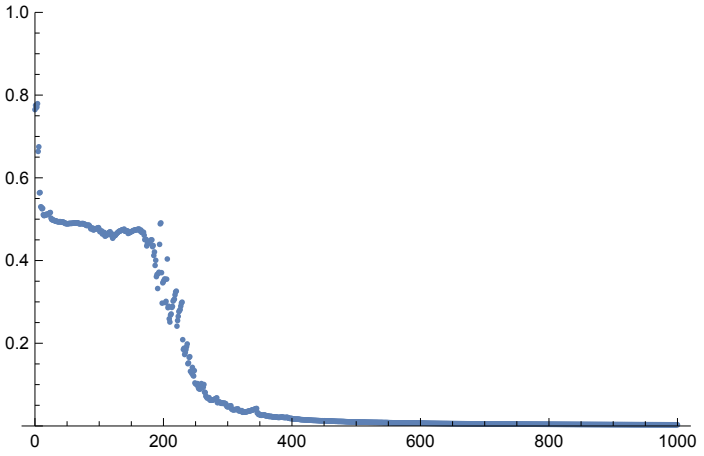
```
inputs = {{-1, 1}, {1, -1}, {1, 1}, {-1, -1}};
outputs = {{1}, {1}, {-1}, {-1}};
```

```
network = InitializeNetwork[{2, 3, 1}];
```

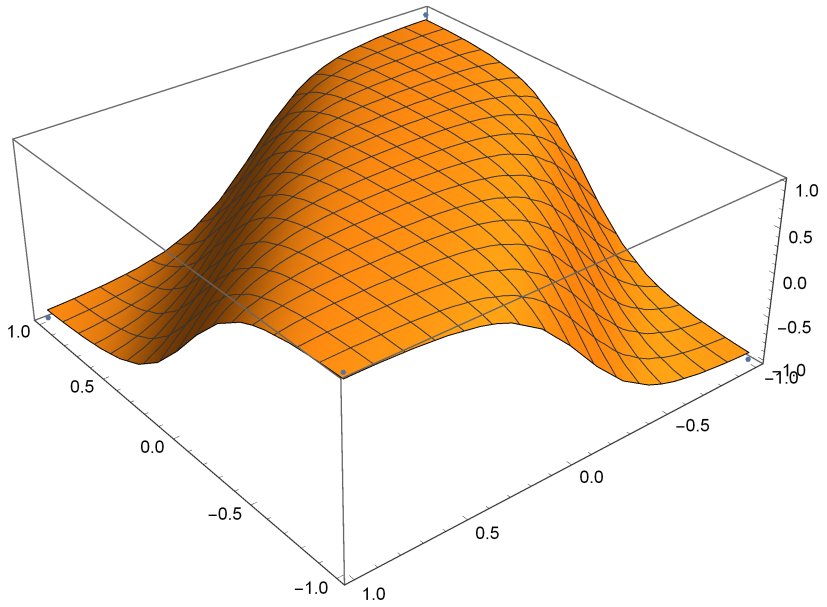
```
Button["Iterate", network =
  Learn[network, Flatten[inputs], Flatten[outputs], Length[inputs], 1, 0.1]]
```

Iterate

```
ListPlot[Table[{iter, (network =
      Learn[network, Flatten[inputs], Flatten[outputs], Length[inputs], 1, 0.1];
     Sum[(outputs[[i]][[1]] - ComputeOutput[network, inputs[[i]]][[1]])^2 /
       (Length[inputs] * 2), {i, 1, Length[inputs]}])},
  {iter, 0, 1000}], PlotRange → {0, 1}]
```




```
Show[Plot3D[ComputeOutput[network, {x, y}][[1]], {x, -1, 1}, {y, -1, 1}],
 ListPointPlot3D[Table[{inputs[[i]][[1]], inputs[[i]][[2]], outputs[[i]][[1]]},
   {i, 1, Length[inputs]}]], PlotRange → All]
```



Cross problem, centered on (0,0)

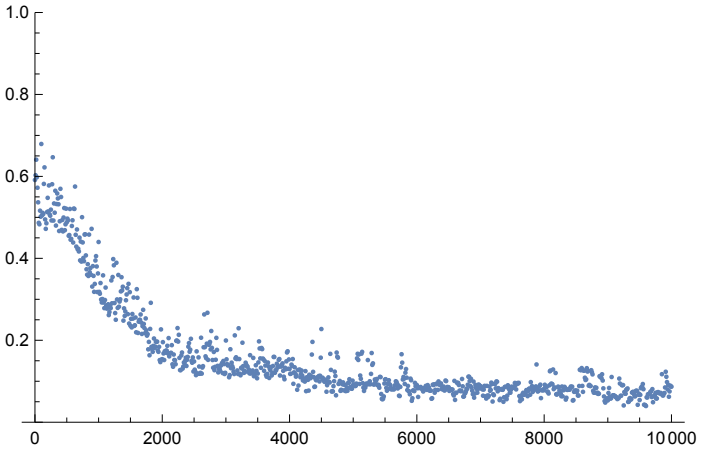
In[116]:=
```
inputs = Table[{RandomReal[{-1, 1}], RandomReal[{-1, 1}]}, {i, 1, 50}];
outputs =
  Table[{If[Abs[inputs[[i]][[1]]] > 0.3 && Abs[inputs[[i]][[2]]] ≥ 0.3, 1, -1 ]},
   {i, 1, Length[inputs]}];

network = InitializeNetwork[{2, 4, 1}];
```

In[119]:=
```
Button["Iterate", network =
  Learn[network, Flatten[inputs], Flatten[outputs], Length[inputs], 1, 0.1]]
```

Out[119]=

Iterate

```
ListPlot[Table[{iter, (network =
     Learn[network, Flatten[inputs], Flatten[outputs], Length[inputs], 10, 0.1];
    Sum[(outputs[[i]][[1]] - ComputeOutput[network, inputs[[i]]][[1]])^2 /
      (Length[inputs] * 2), {i, 1, Length[inputs]}])},
  {iter, 0, 10000, 10}], PlotRange → {0, 1}]
```




```
Show[Plot3D[ComputeOutput[network, {x, y}][[1]], {x, -1, 1}, {y, -1, 1}],
 ListPointPlot3D[Table[{inputs[[i]][[1]], inputs[[i]][[2]], outputs[[i]][[1]]},
   {i, 1, Length[inputs]}]], PlotRange → All]
```