Spectrogram Project - Transfer Learning

The data used for this project was obtained from the University of Iowa Electronic Music Studios.

The random seed is so the splitting between training, validation, and testing is consistent. If you are training on a GPU, your networks may not be the same if you train the same network multiple times.

```
rng(123)
```

Load and split data

The images are stored in the folder `Spectrograms`. The data for each instrument is separated in subfolders, labelled by the folder name.

Split the data so that 80% of the images are used for training, 10% are used for validation, and the rest are used for testing.

```
ds = imageDatastore("MusicProject/Spectrograms","IncludeSubfolders",true,"LabelSource","folderr
[trI,vlI,tsI] = splitEachLabel(ds,0.8,0.1,0.1,"randomized");
```

Resize the data datastores so that the images are `[224 224]`.

```
trds = augmentedImageDatastore([224 224],trI);
vlds = augmentedImageDatastore([224 224],vlI);
tsds = augmentedImageDatastore([224 224],tsI);
```

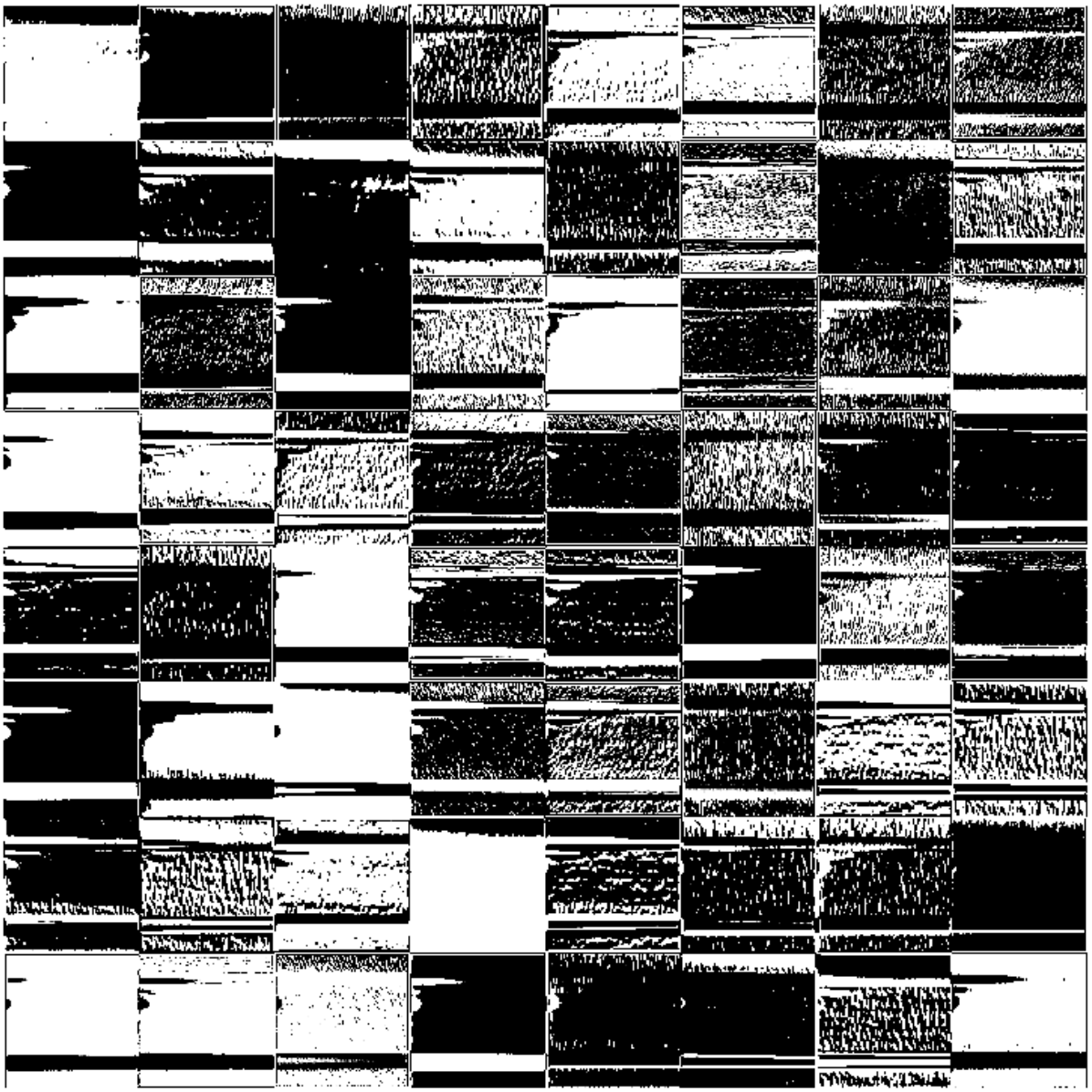
View activations from GoogLeNet

Read in the first spectrogram.

```
a=readimage(trI,1);
a=imresize(a,[224 224]);
```

View activations from the `conv1-7x7_s2` layer in GoogLeNet for feature extraction.

```
net=googlenet;
f=activations(net,a,"conv1-7x7_s2");
montage(f)
```



Modify final layers for transfer learning

The fully connected layer and classification layer from GoogLeNet are replaced using deepNetworkDesigner(). Output size of new fullyconnected layer = 14 = number of instruments in this dataset.

```
deepNetworkDesigner()
```

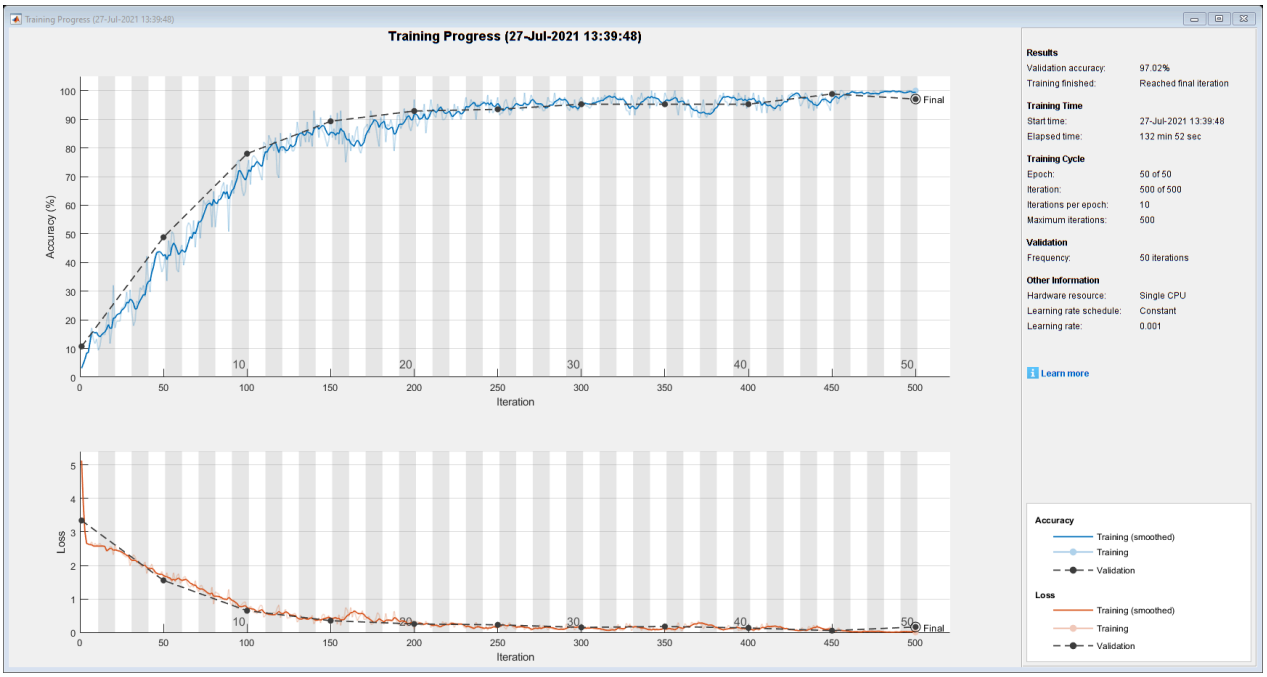
Train the network

Set the training options and train the network.

```
opt=trainingOptions("adam","Plots","training-progress","ValidationData",vlds,"MaxEpochs",50);
trl=trainNetwork(trds,lgraph_1,opt);
```

```
Training on single CPU.
Initializing input data normalization.
```

Epoch	Iteration	Time Elapsed (hh:mm:ss)	Mini-batch Accuracy	Validation Accuracy	Mini-batch Loss	Validation Loss	Base Learnir Rate
1	1	00:00:27	3.13%	10.71%	5.1310	3.3404	0.00
5	50	00:13:24	38.28%	48.81%	1.6500	1.5536	0.00
10	100	00:27:03	72.66%	77.98%	0.6704	0.6479	0.00
15	150	00:40:05	91.41%	89.29%	0.2763	0.3493	0.00
20	200	00:53:25	96.88%	92.86%	0.1086	0.2518	0.00
25	250	01:06:29	97.66%	93.45%	0.1216	0.2267	0.00
30	300	01:20:19	97.66%	95.24%	0.0857	0.1498	0.00
35	350	01:33:28	99.22%	95.24%	0.0198	0.1766	0.00
40	400	01:46:32	97.66%	95.24%	0.0739	0.1327	0.00
45	450	01:59:31	99.22%	98.81%	0.0321	0.0523	0.00
50	500	02:12:46	100.00%	97.02%	0.0026	0.1620	0.00



Evaluate network

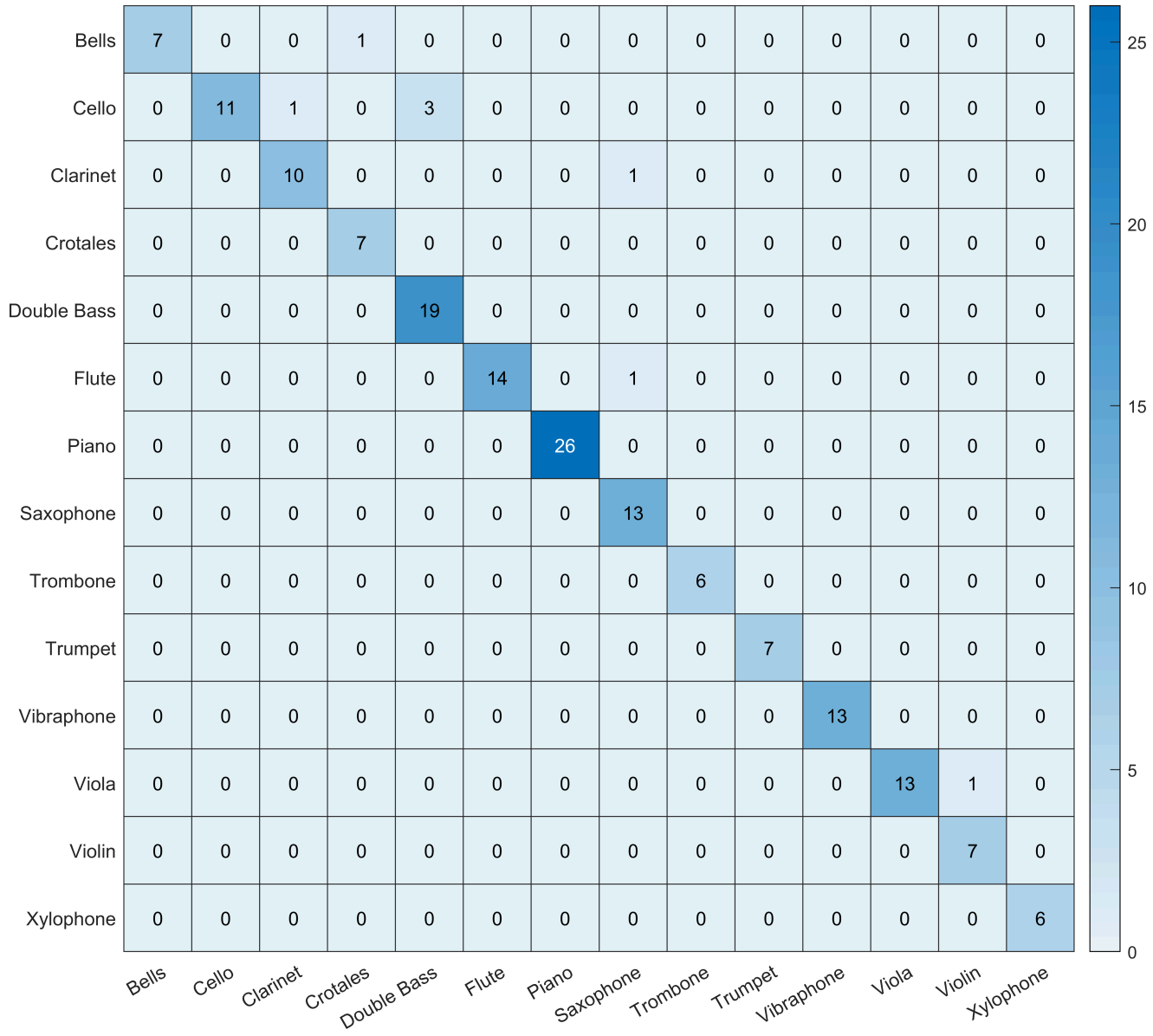
Calculate the accuracy on the test dataset.

```
pred=classify(trl,tsds);
nnz(pred==tsI.Labels)/numel(tsI.Labels)
```

```
ans = 0.9521
```

Plot confusion matrix

```
[cmap,clabel]=confusionmat(tsI.Labels,pred);
heatmap(clabel,clabel,cmap)
```




```
whos trl
```

```
  Name      Size                Bytes  Class        Attributes

  trl       1x1              24291440  DAGNetwork
```