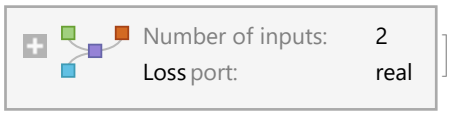
Load the MIDI tools:

In[ ]:=
```
SetDirectory[NotebookDirectory[]];
<< "../Howl/HowlMidiTools.wl"
```

In[ ]:=
```
encToNetInput[encSong_] := <|
  "NoteData" → encSong[[All, 1 ;; 3]],
  "Notes" → encSong[[All, 4]]
 |>
```

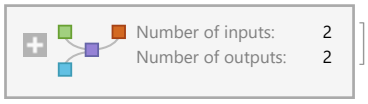
This is how to get the predictor from a training net (i.e. trnn):

In[ ]:=
```
trained = Import[
  "checkpoints_2021-07-21T12-31-21\\2021-07-21T12-31-33_0_4971_54680_2.62e+1_2.39e+1.
    wlnet"]
```

Out[ ]= NetGraph[]

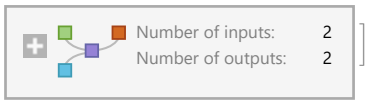

```
getPredictor[trained_] := NetGraph[<|
   "rnn" → NetExtract[ trained, "rnn"],
   "lastPred" → SequenceLastLayer[],
   "lastDataPred" → SequenceLastLayer[]
   |>,
  {
   NetPort["rnn", "NotePred"] → "lastPred" → NetPort["NotesPred"],
   NetPort["rnn", "NoteDataPred"] → "lastDataPred" → NetPort["NoteDataPred"]
  },
  "Notes" → {"Varying", NetEncoder[{"Class", validNotes}] },
  "NotesPred" → NetDecoder[{"Class", validNotes}]
 ]
```

```
getPredictor[trained]
```

Out[ ]= NetGraph[]

This is how to import a standard predictor - output by the training script as predictor_xxx.wlnet

```
predictor =
 Import["checkpoints_2021-07-22T05-13-24\\predictor_2021-07-22T05-13-24.wlnet"]
```

Out[ ]= NetGraph[]

This is how to generate music from a predictor network:

```
ClearAll[fromPred, firstNote]
fromPred[pred_] :=
 Transpose@Join[Transpose[pred["NoteDataPred"]], {pred["NotesPred"]}]
firstNote[] := {{RandomReal[], RandomReal[],
   RandomReal[{0.3, 1.0}], RandomInteger[{-12, 24}]}}
makeMusic[predictor_, firstNote_, len_] := Nest[
    Join[#, {fromPred[predictor[
         encToNetInput[#[[-Min[Length@#, 500] ;;]]], TargetDevice → {"GPU", 2}]]}] &,
    firstNote, len] // HowlDecodeNotesV1 // Sound
```

In[ ]:=
```
makeMusic[predictor, firstNote[], 500]
```

Out[ ]=

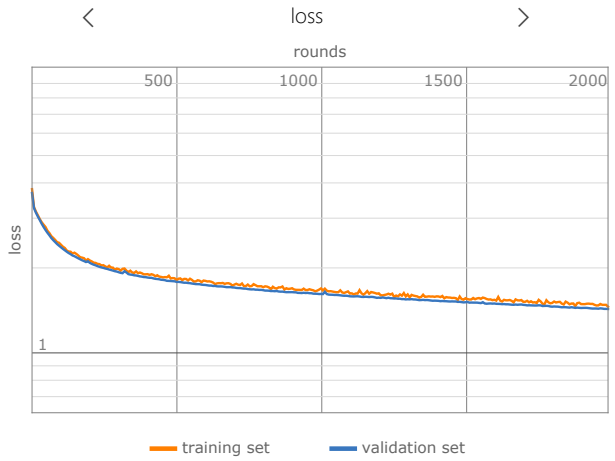
512 node GRU

In[ ]:=
```
results = Import["checkpoints_2021-07-22T20-36-58\\results_2021-07-22T20-36-58.wxf"]
predictor =
 Import["checkpoints_2021-07-22T20-36-58\\predictor_2021-07-22T20-36-58.wlnet"]
```

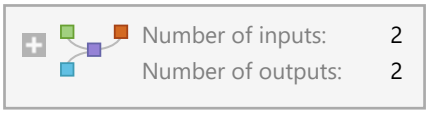
Out[ ]= NetTrainResultsObject

NetTrain Results

summary	batches: 73 557, rounds: 1988, time: 12h, examples/s: 109
data	training examples: 2368, validation examples: 290, processed examples: 4 707 648, skipped examples: 0
method	ADAM optimizer, batch size 64, GPU 1
round	loss: 1.48, error: 36.4%
validation	loss: 1.43, error: 35.7%

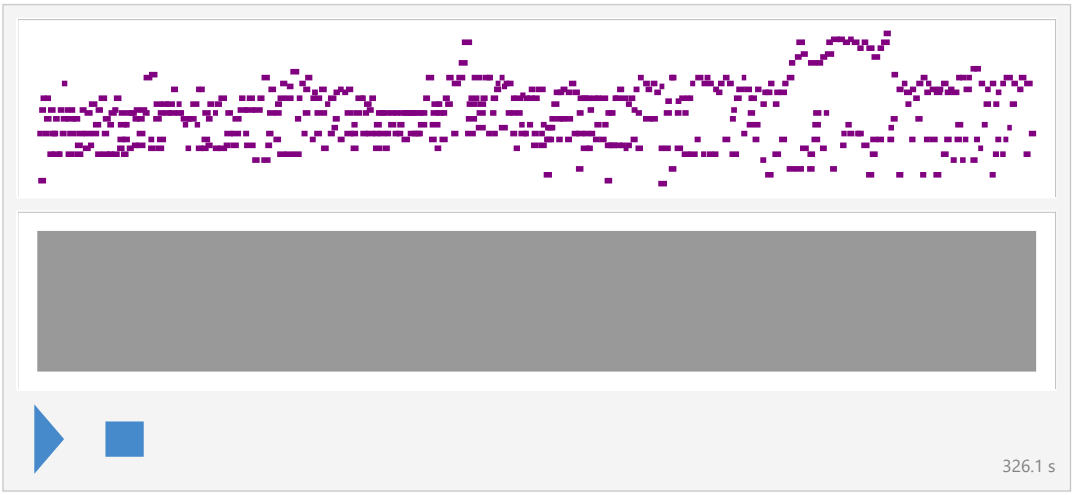


Out[ ]= NetGraph



In[ ]:=
```
makeMusic[predictor, firstNote[], 500]
```

Out[ ]=



In[ ]:=
```
dateTimeStr = StringReplace[DateString["ISODateTime"], ":" → "-"];
Export["rnn_gru_512_" <> dateTimeStr <> ".mid", %23]
```

Out[ ]=
```
rnn_gru_512_2021-07-23T09-01-01.mid
```

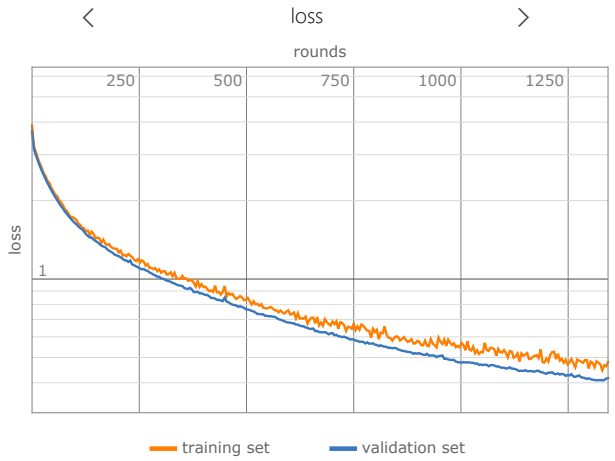
1024 Node LSTM

In[ ]:=
```
results = Import["checkpoints_2021-07-22T21-40-55\\results_2021-07-22T21-40-55.wxf"]
predictor =
 Import["checkpoints_2021-07-22T21-40-55\\predictor_2021-07-22T21-40-55.wlnet"]
```

Out[ ]= NetTrainResultsObject

NetTrain Results

summary	batches: 130 336, rounds: 1343, time: 12h, examples/s: 72.
data	training examples: 2328, validation examples: 290, processed examples: 3 128 064, skipped examples: 0
method	ADAM optimizer, batch size 24, GPU 2
round	loss: 5.18×10^{-1}, error: 7.74%
validation	loss: 4.06×10^{-1}, error: 7.00%

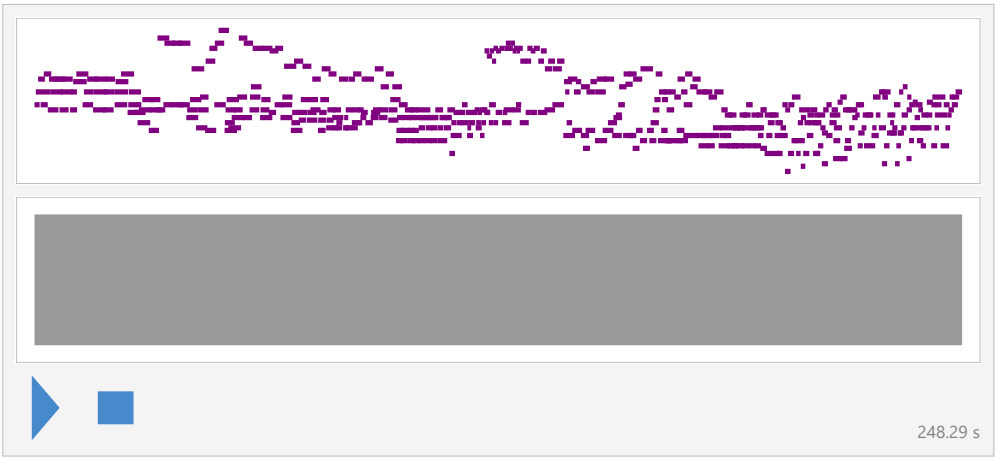


Out[ ]= NetGraph

Number of inputs: 2
Number of outputs: 2

In[ ]:=
```
makeMusic[predictor, firstNote[], 500]
```

Out[ ]=



In[ ]:=
```
dateTimeStr = StringReplace[DateString["ISODateTime"], ":" → "-"];
Export["rnn_lstm_1024_" <> dateTimeStr <> ".mid", %96]
```

Out[ ]=
```
rnn_lstm_1024_2021-07-23T11-38-25.mid
```

416 node LSTM

Note, I lost the first 6 hours of training this one. So this is several hours in.

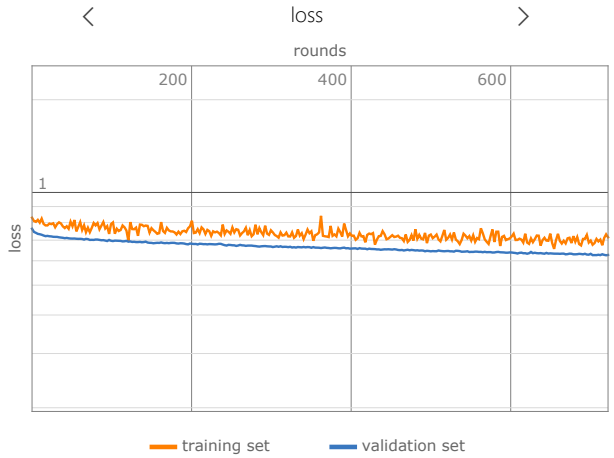
In[ ]:=
```
results = Import["checkpoints_2021-07-23T18-20-47\\results_2021-07-23T18-20-47.wxf"]
```

Out[ ]=

NetTrainResultsObject[

NetTrain Results

summary	batches: 70124, rounds: 722, time: 4.0h, examples/s: 117
data	training examples: 2328, validation examples: 290, processed examples: 1682976, skipped examples: 0
method	ADAM optimizer, batch size 24, GPU 1
round	loss: 7.7×10^{-1}, error: 16.0%
validation	loss: 6.29×10^{-1}, error: 15.2%

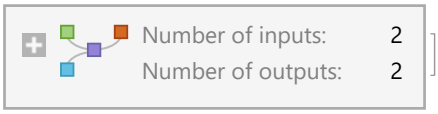


]

In[ ]:=
```
predictor =
 Import["checkpoints_2021-07-23T18-20-47\\predictor_2021-07-23T18-20-47.wlnet"]
```

Out[ ]=

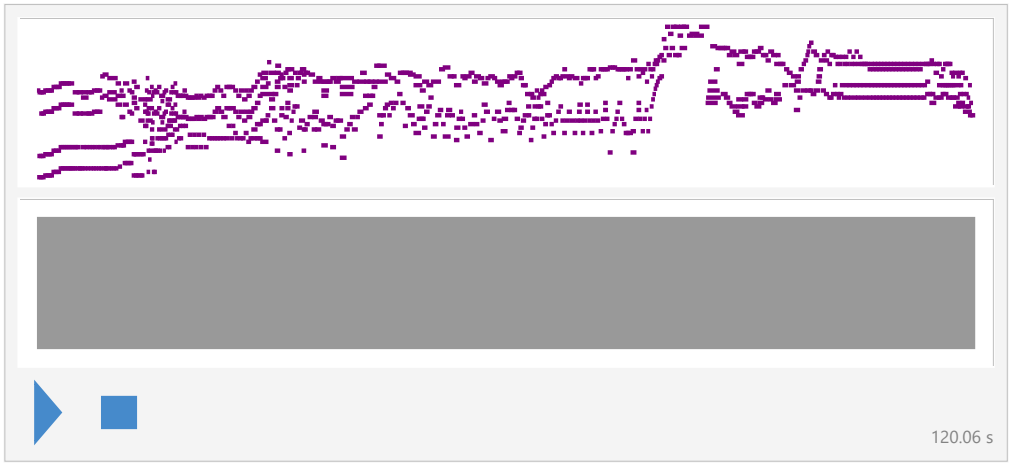
NetGraph[



]

In[ ]:=
```
makeMusic[predictor, firstNote[], 1000]
```

Out[ ]=



```
In[ ]:= dateTimeStr = StringReplace[DateString["ISODateTime"], ":" → "-"];
        Export["rnn_lstm_416_" <> dateTimeStr <> ".mid", %12]
Out[ ]= rnn_lstm_416_2021-07-24T01-36-13.mid
```