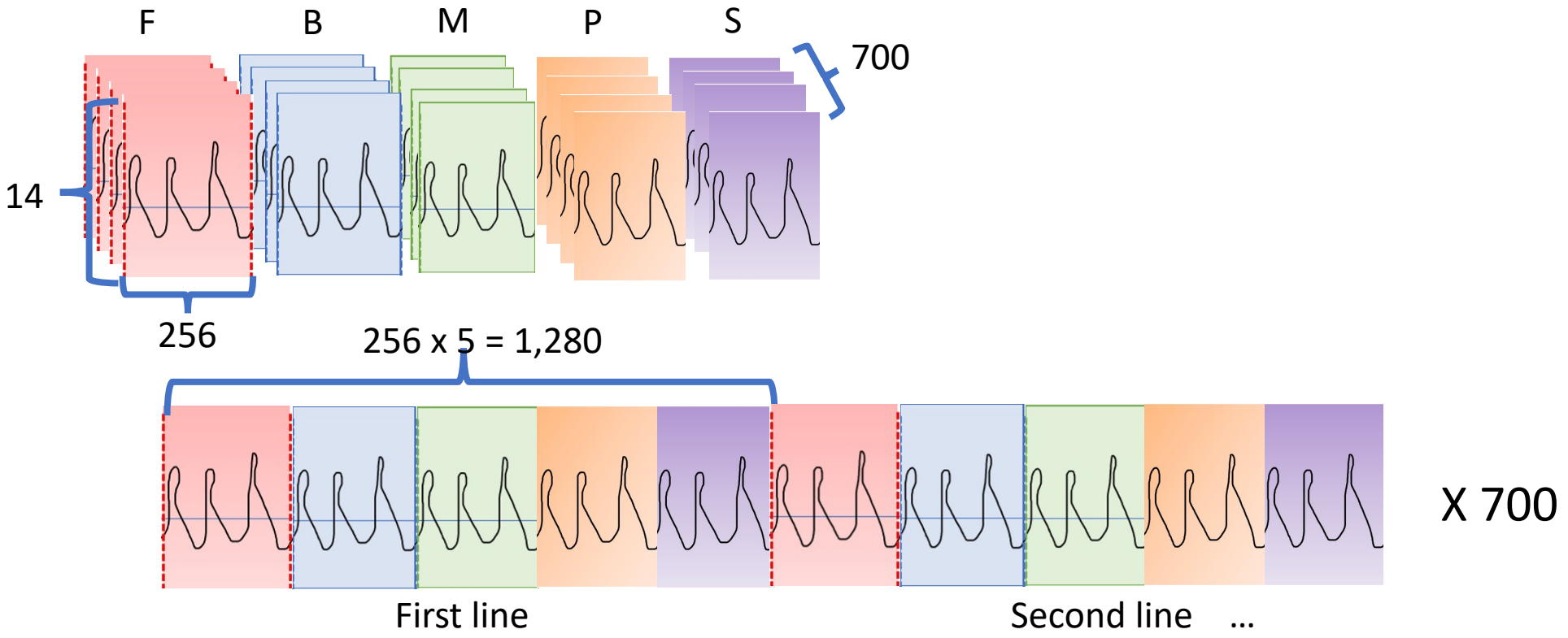
Shape of input

Pattern.2 : 14 x 896,000

(256 samples x 5 word patterns x 700 batches)



Result

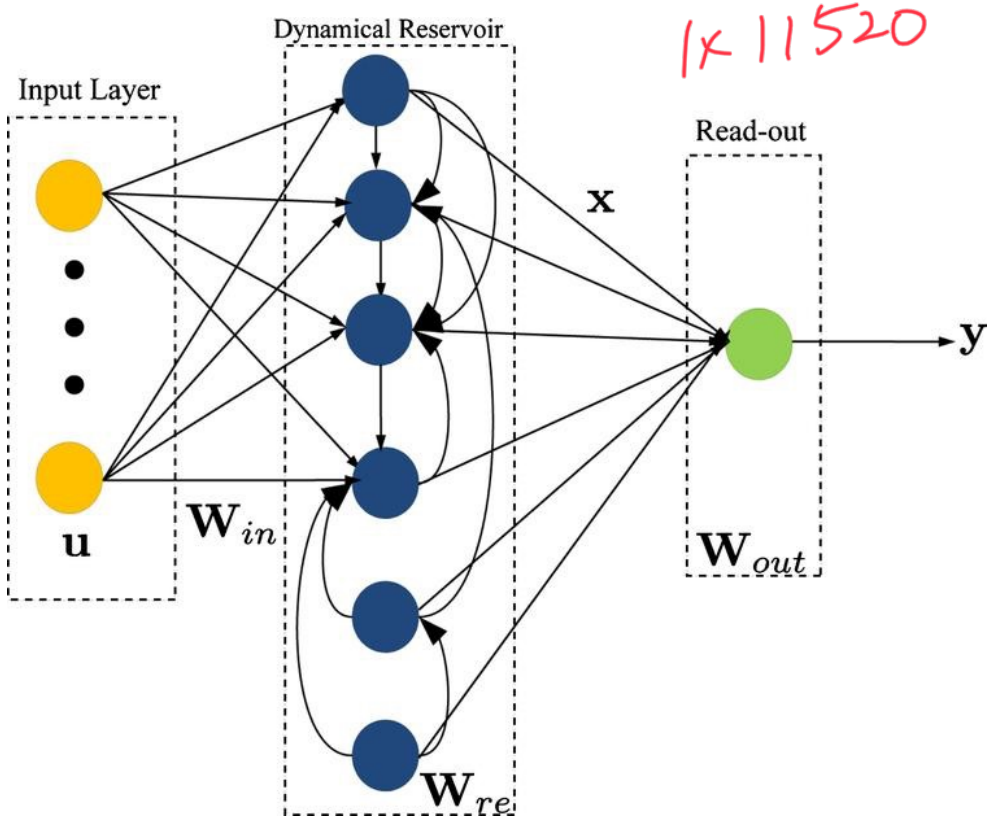
- Using ESN, the accuracy was around **25 %**

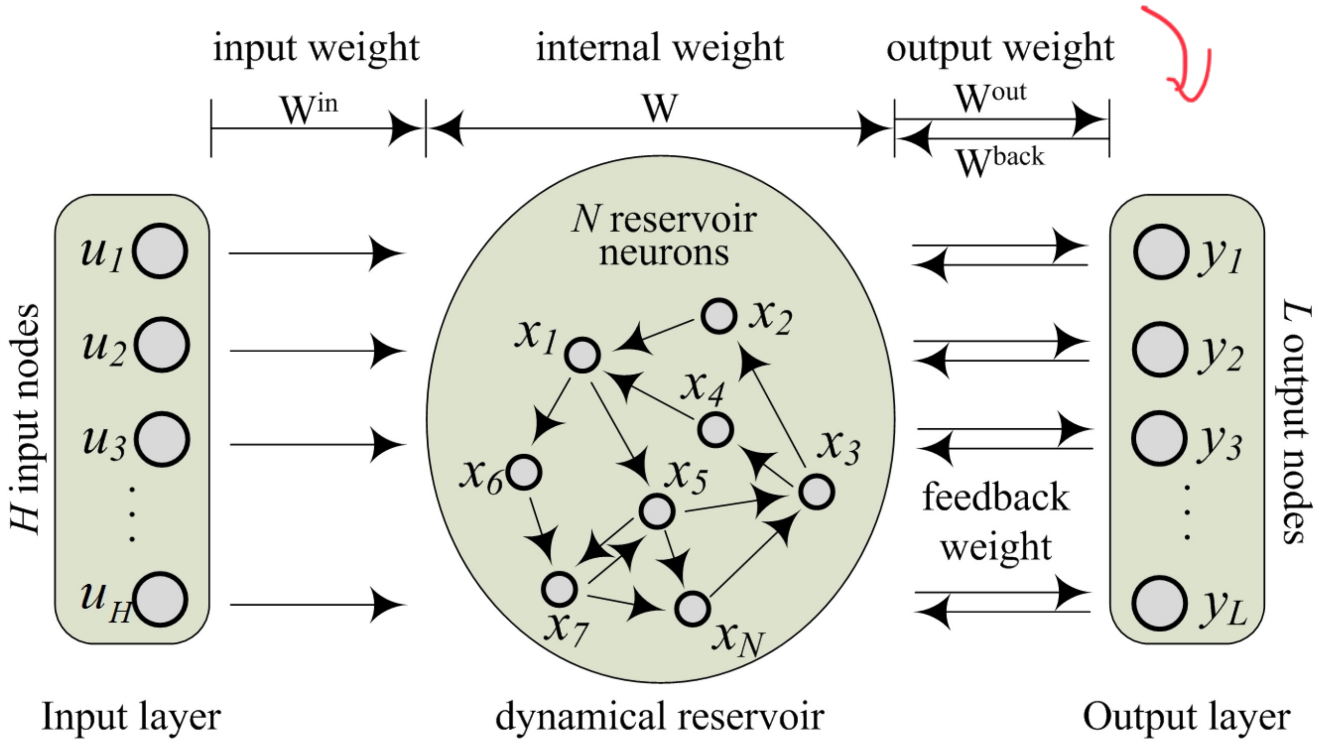
- Maybe difficult? This study is for verifying whether the pre-speech EEG can predict speech

  (At least, it may be hard with this current model)

- For improvement;
  - Epoch from -1 ~ 0 s to - 0.5 ~ 0 s
  - we can set the five-output layer for each weight.
  - Noise-canceling of EEG by ICA
  - (Maybe frequency value?)
  - Another model for making sure (LSTM)
  - At RIT, we will collect data from native speakers. Shorten the recording time

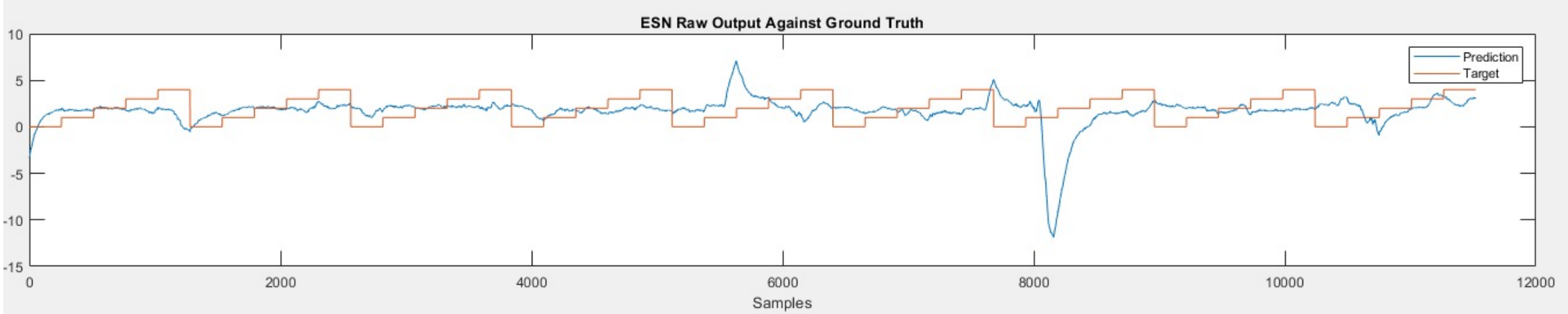
$$\mathbf{x}(n+1) = f(\mathbf{W}\mathbf{x}(n) + \mathbf{W}^{in}\mathbf{u}(n+1) + \mathbf{W}^{fb}\mathbf{y}(n)),$$

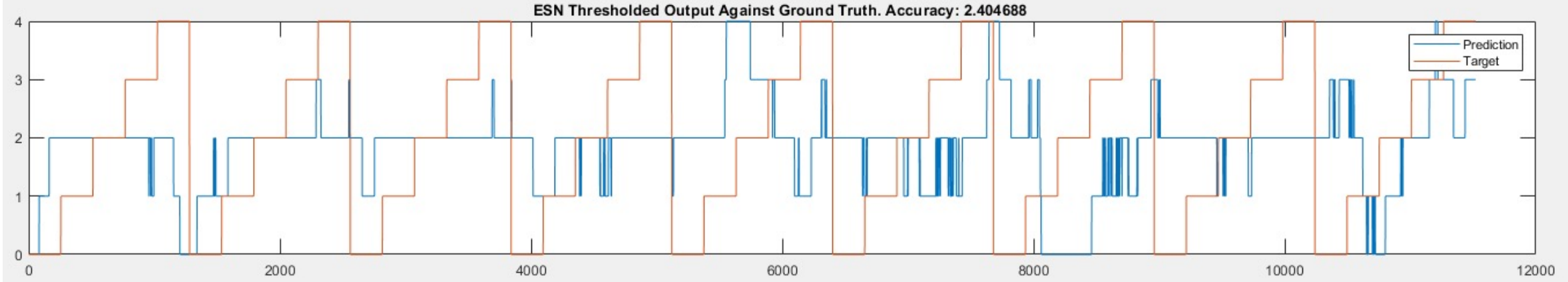


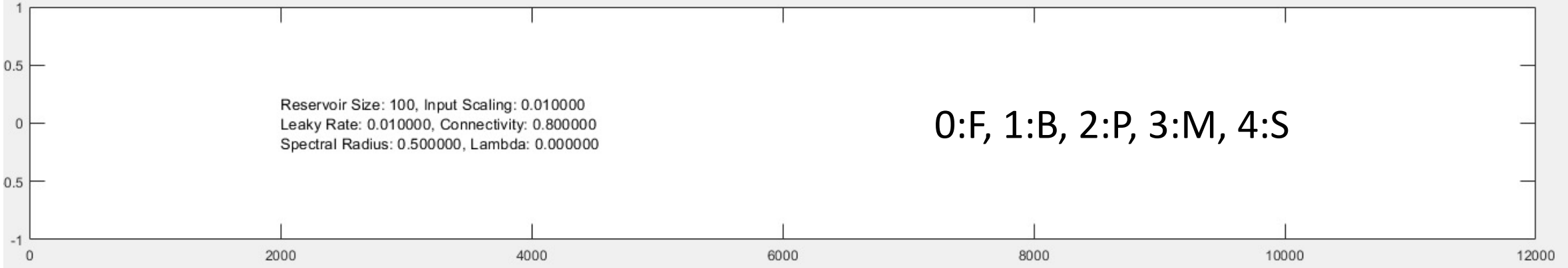


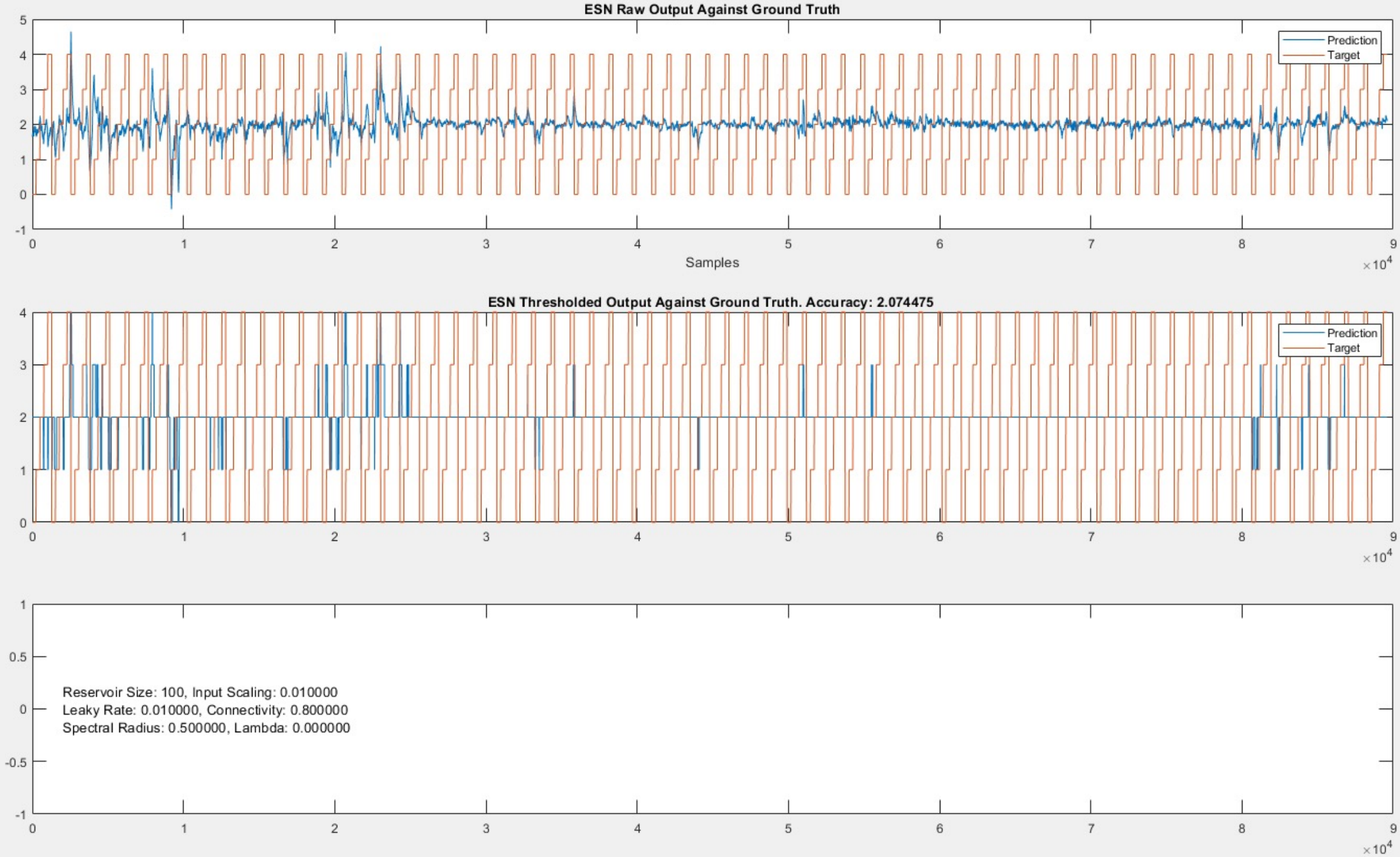
https://images.app.goo.gl/dfdTHF5yLAHvPmGo7

https://images.app.goo.gl/FEo8CcaUYtDNhEZH6


ESN Raw Output Against Ground Truth
Prediction
Target
Samples

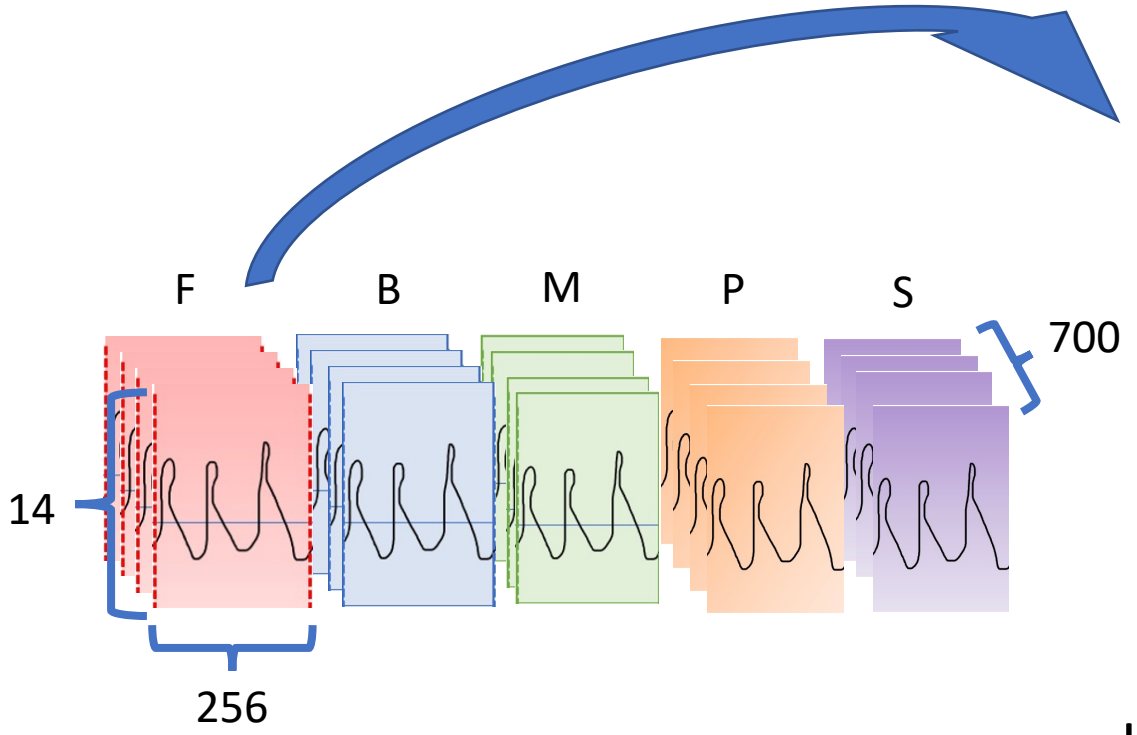

ESN Thresholded Output Against Ground Truth. Accuracy: 2.404688
Prediction
Target

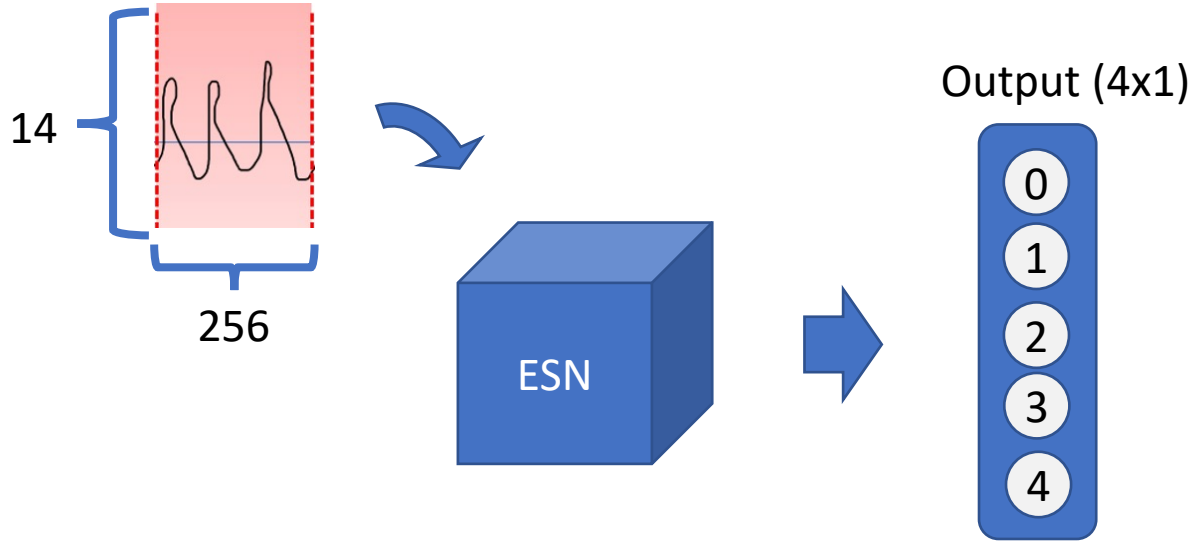

Reservoir Size: 100, Input Scaling: 0.010000
Leaky Rate: 0.010000, Connectivity: 0.800000
Spectral Radius: 0.500000, Lambda: 0.000000
0:F, 1:B, 2:P, 3:M, 4:S


ESN Raw Output Against Ground Truth
Prediction
Target
Samples
×10^4
ESN Thresholded Output Against Ground Truth. Accuracy: 2.074475
Prediction
Target
×10^4
Reservoir Size: 100, Input Scaling: 0.010000
Leaky Rate: 0.010000, Connectivity: 0.800000
Spectral Radius: 0.500000, Lambda: 0.000000
×10^4

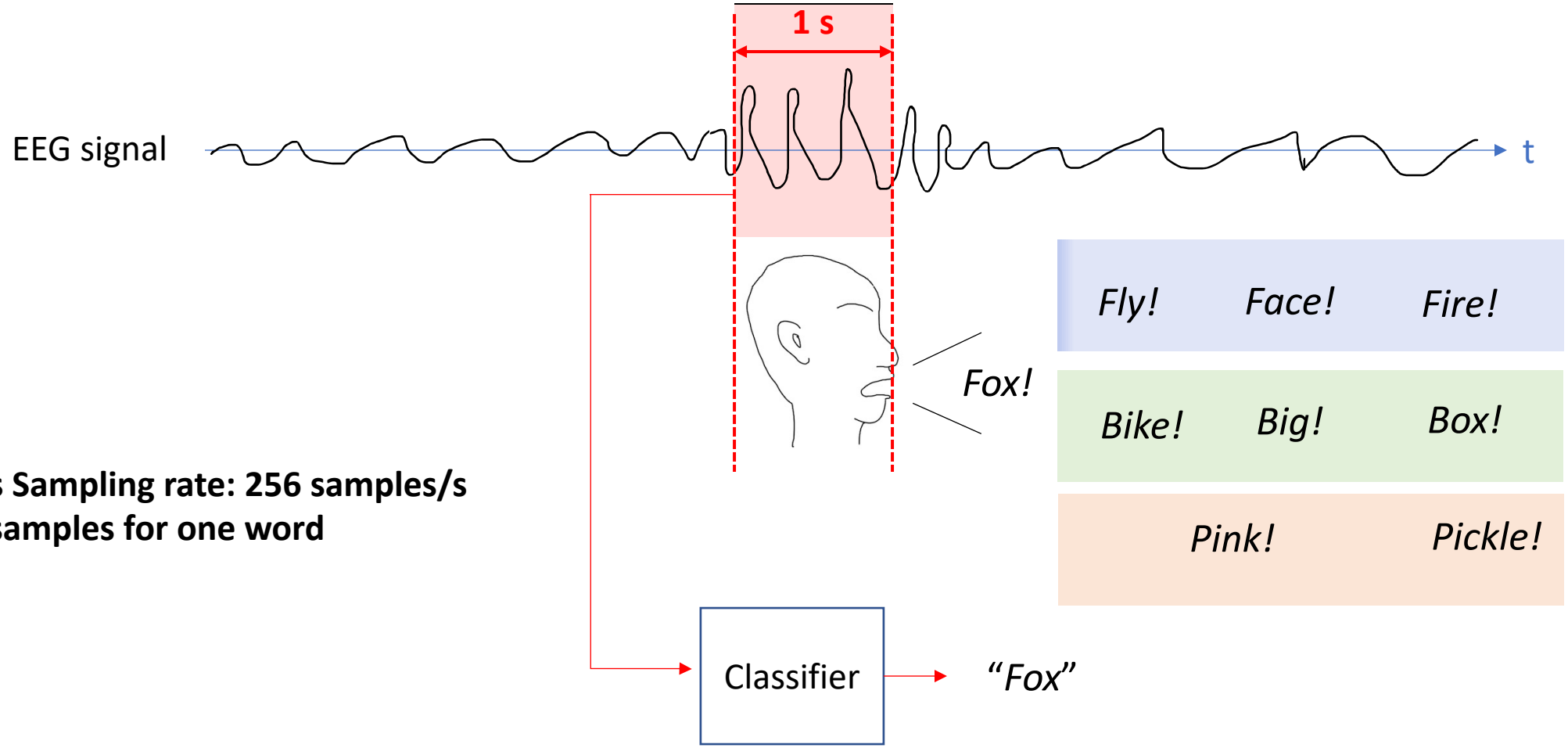
Shape of input and output

1. 14x256x3500 → 14 channels x 256 samples x 3500 batches
   (700x5) (700 batches x5 words)

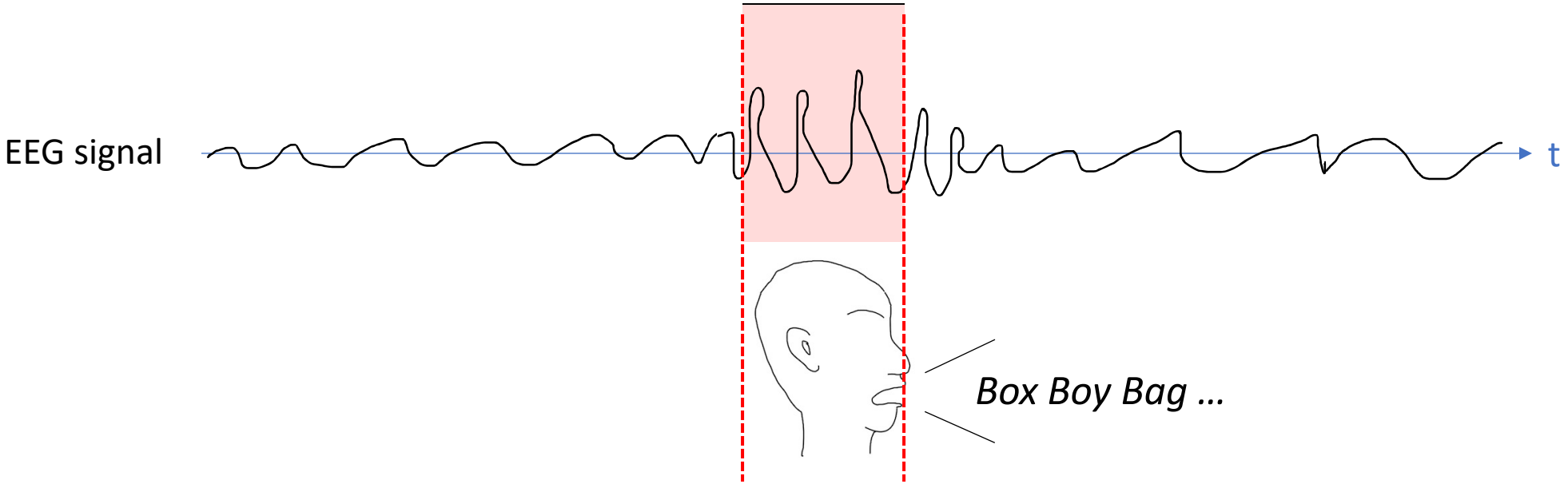




In total, 14x256x3500 (including train and test)



Emotiv’s Sampling rate: 256 samples/s
→256 samples for one word


EEG signal
t
Box Boy Bag …

Phenome Category	Word Prompts 20 20 20 20 20 x x x x x
F	Face, Fox, Fly, Free, Fun
B	Box, Bike, Body, Boom, Born
P	Pan, Pink, Push, Pool, Peace
M	Milk, Mix, Mind, Mood, Mood
S	Sing, Soul, Sea, Six, Son

20 x 5 = 100

20 x 5 = 100

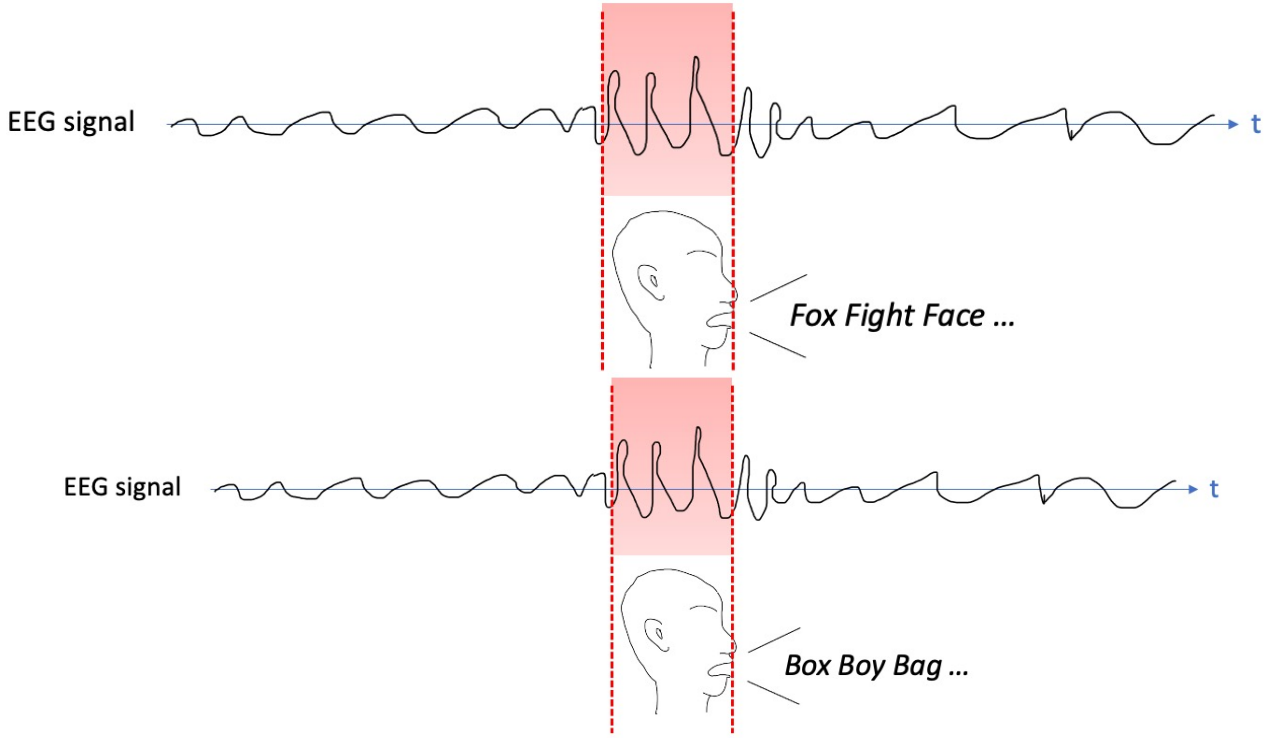
20 x 5 = 100

20 x 5 = 100

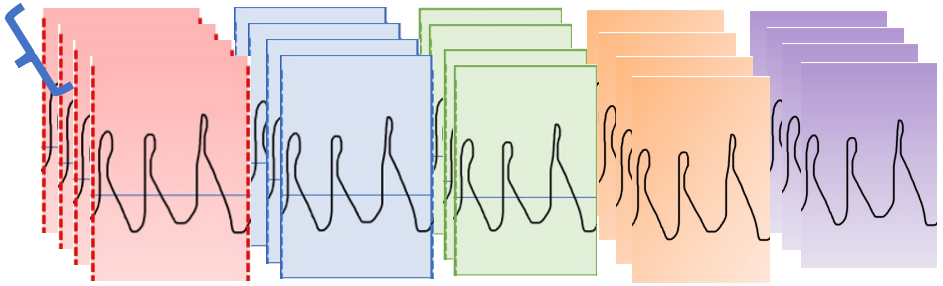
20 x 5 = 100

***Each word was spoken 20 times**

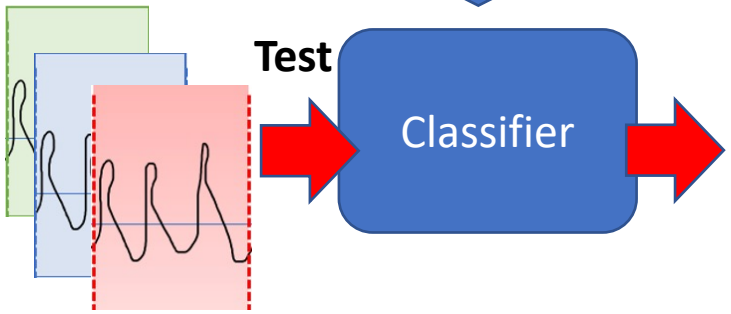
→For one phenome, each subject spoke the phenome 20x5 =100 times



Collected Data



Training



“Ma”

“Ba”

“Pa”

Accuracy: ??%

.
.
.

If we can get high accuracies, enable to move onto using “words”, instead of monosyllables >>> Next slide

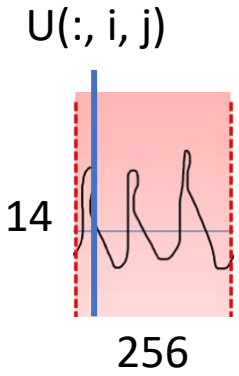
x 100

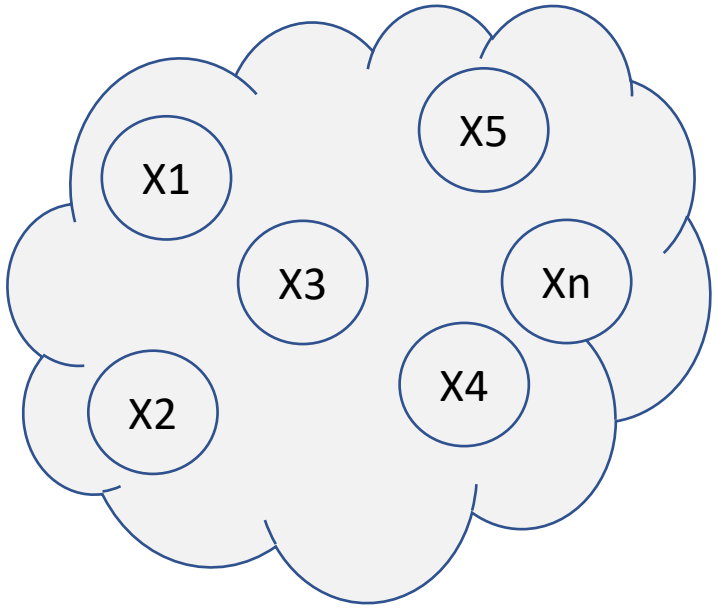
Output Weight Updates

- Our ESN updates only the output weight.

esn.OO(”regression”, X, trainy);

% esn is updated by this statement with the target.





x_ = sigmoid();

x = update

X(:,idx) = x;