Basic Deep Neural Network Beamforming Demonstration

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beam
BIOMEDICAL ELASTICITY & ACOUSTIC MEASUREMENT LAB

VISE

Basic DNN Beamforming Pipeline

1 – Make training data

2 – Split up training data

3 – Train a network

4 – Evaluate a network

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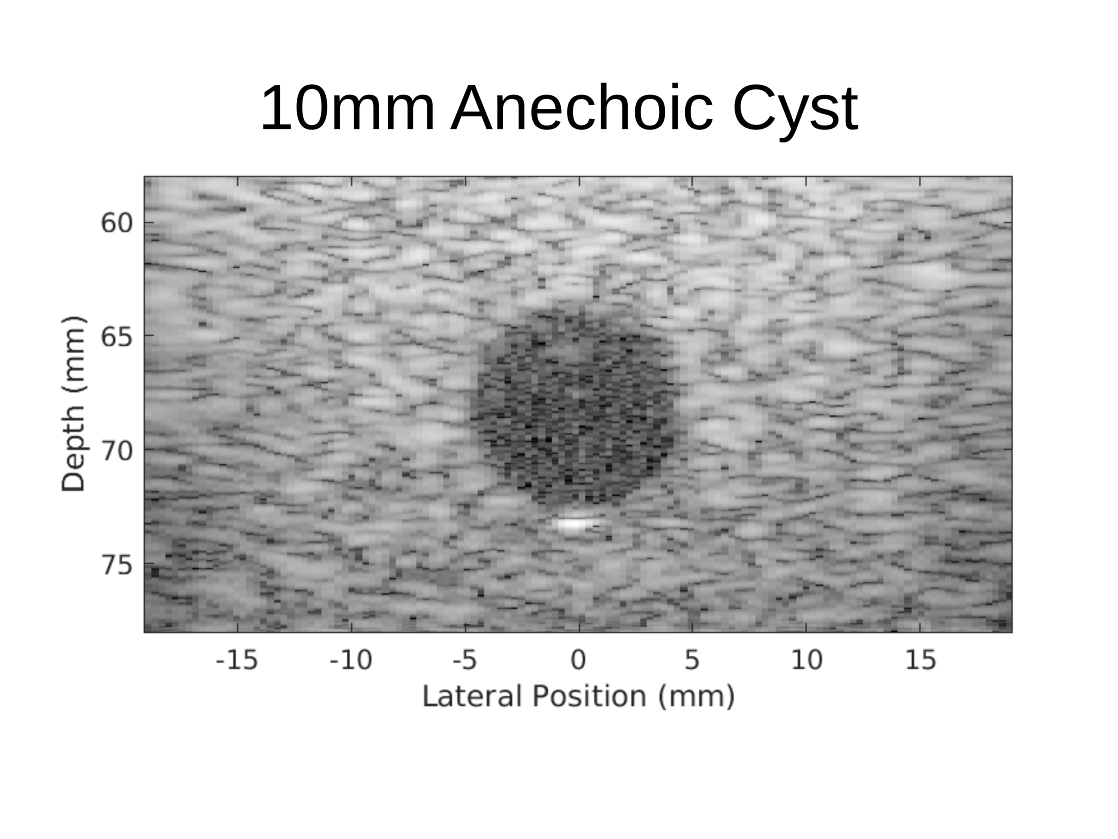
Example Training Data

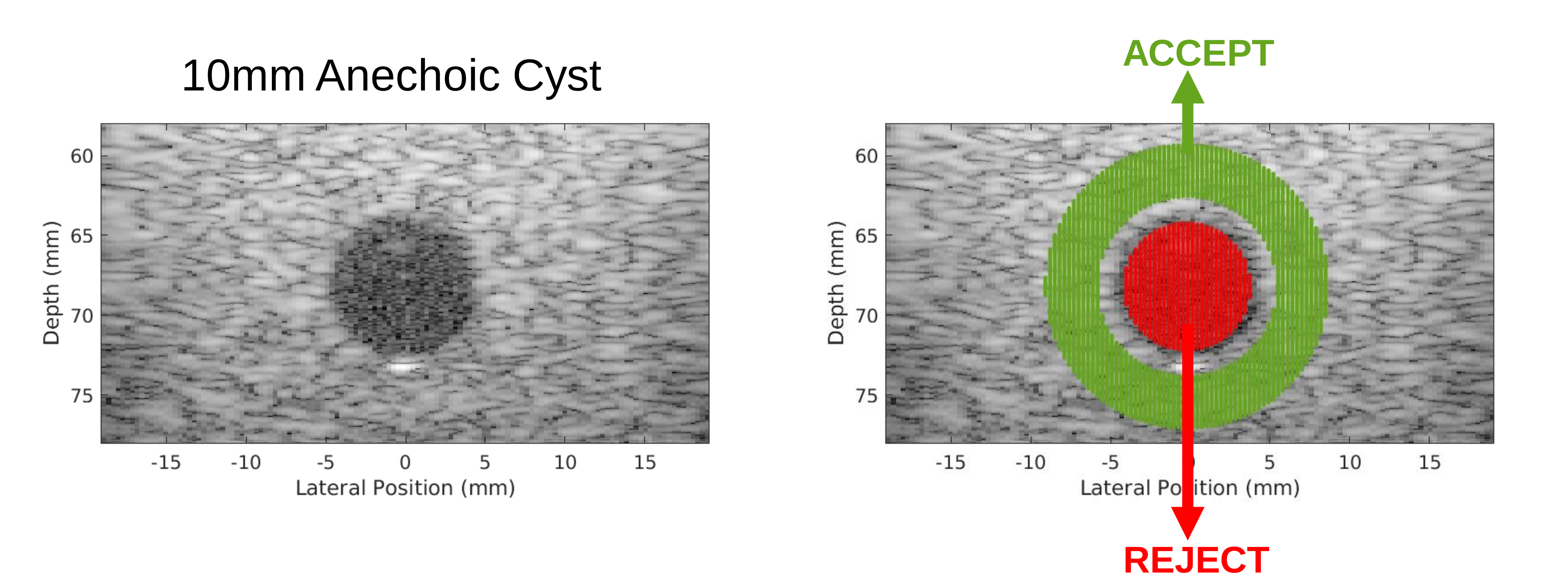
Location: train_data/example_phantom_10mm_70mm/



- 10 channel data sets
- 9,135 aperture examples per channel data set
- Verasonics L74
- 5MHz center frequency
- 70mm transmit focus

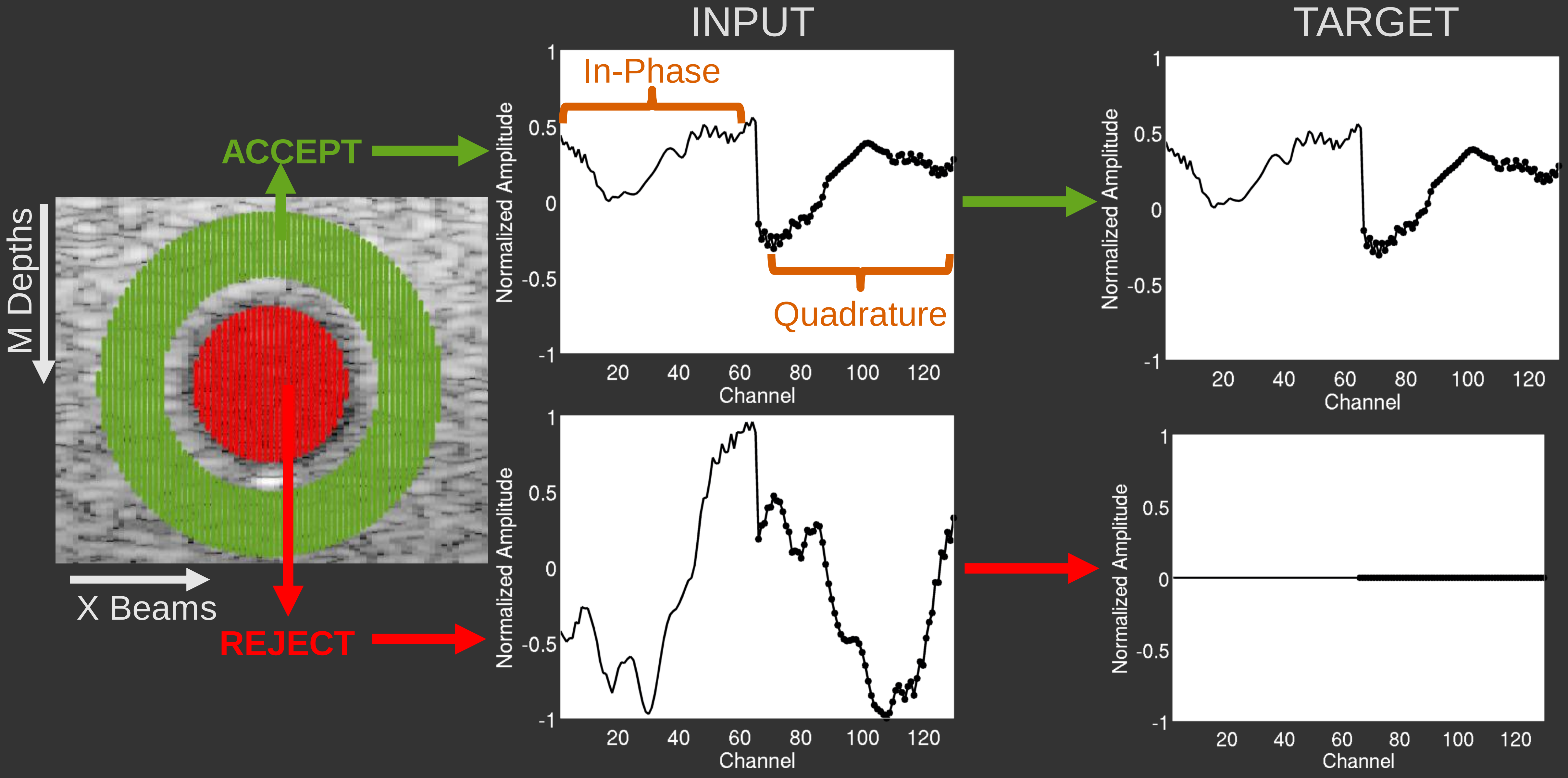
Example Training Data

Location: train_data/example_phantom_10mm_70mm/



NOTE: Accept and reject regions are not balanced for this example demo. There are approximately 6,845 accept signals and 2,290 reject signals extracted from each cyst realization.

Example Training Data



INPUT

TARGET

ACCEPT

REJECT

M Depths

X Beams

In-Phase

Quadrature

Example Training Data

Location: train_data/example_phantom_10mm_70mm/

MATLAB functions provided in train_data/

createTrainingDataWrapper.m

createTrainingData.m

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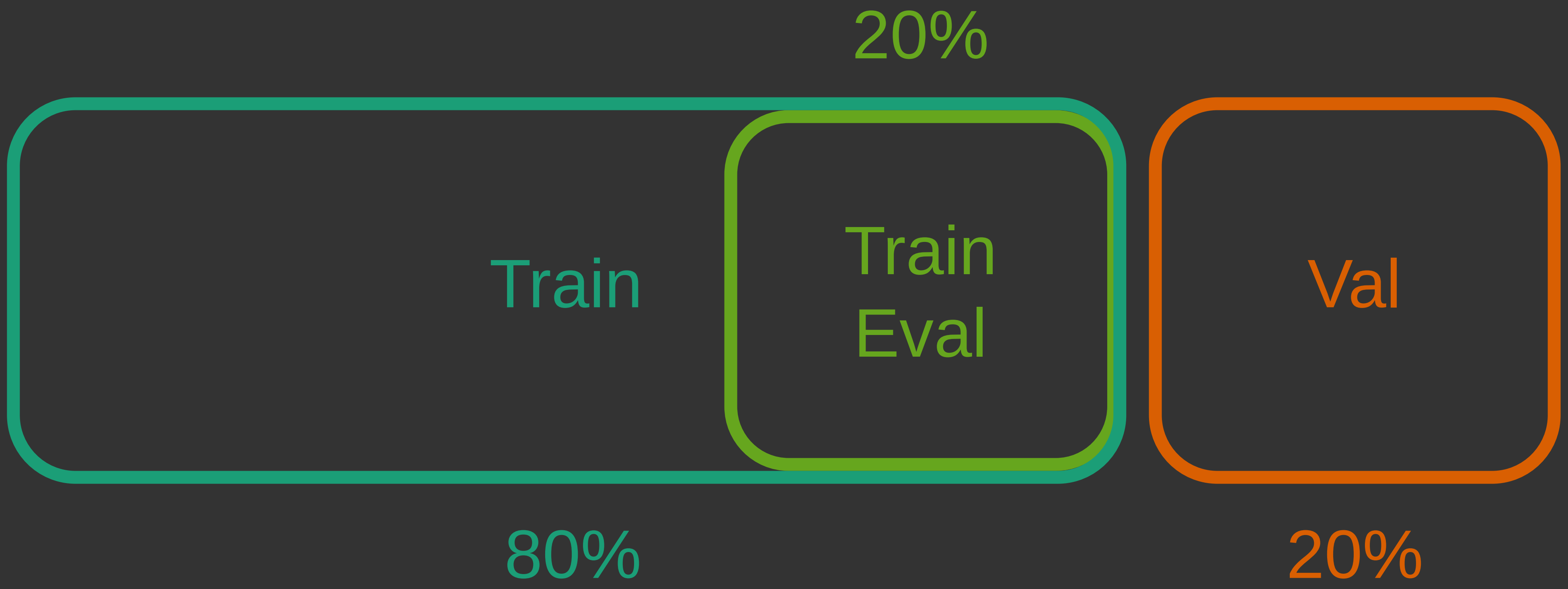
Example Training Data

Location: train_data/example_phantom_10mm_70mm/json/



20%

Train

Train Eval

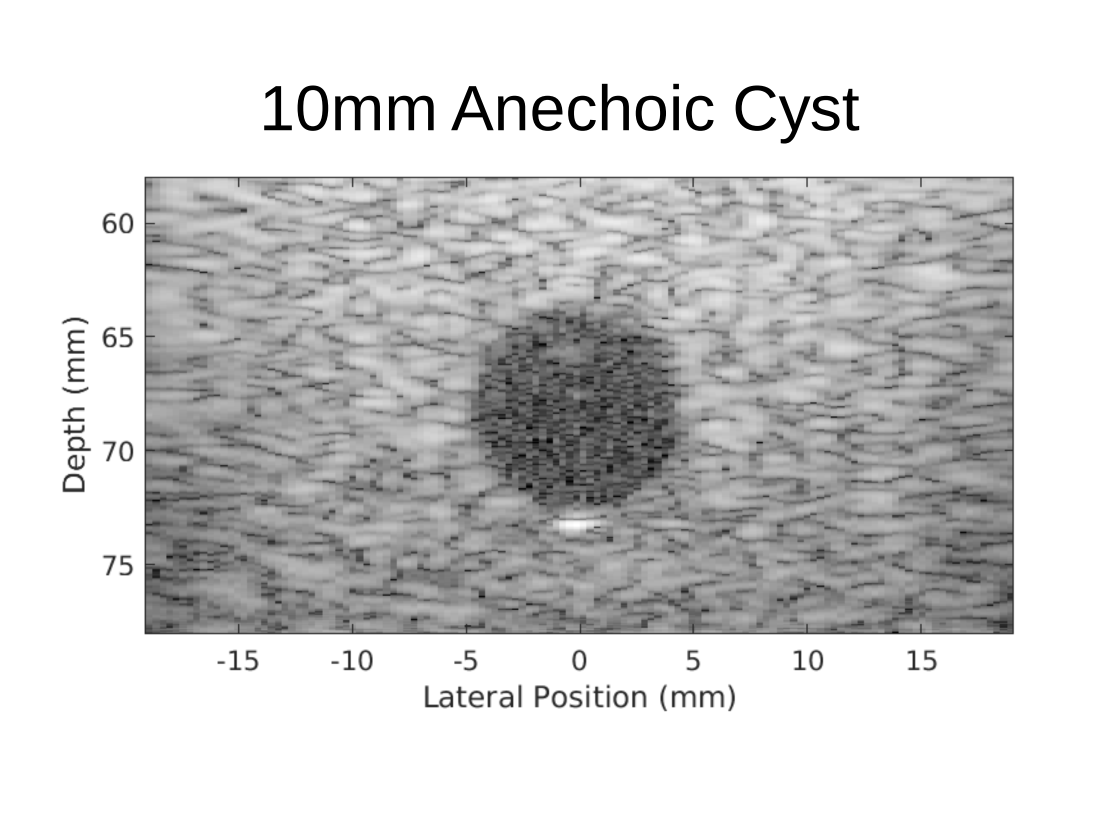
Val

80%

20%

Example Training Data

Location: train_data/example_phantom_10mm_70mm/json/



- 10 channel data sets
- 9,135 aperture examples per channel data set
- 8 used for training (73,087 total examples)
- 2 of the 8 training examples used for train eval
- 2 used for validation (18,270 total examples)

Example Training Data

Location: train_data/example_phantom_10mm_70mm/

Python script provided in train_data/json/
phantom10mm.py

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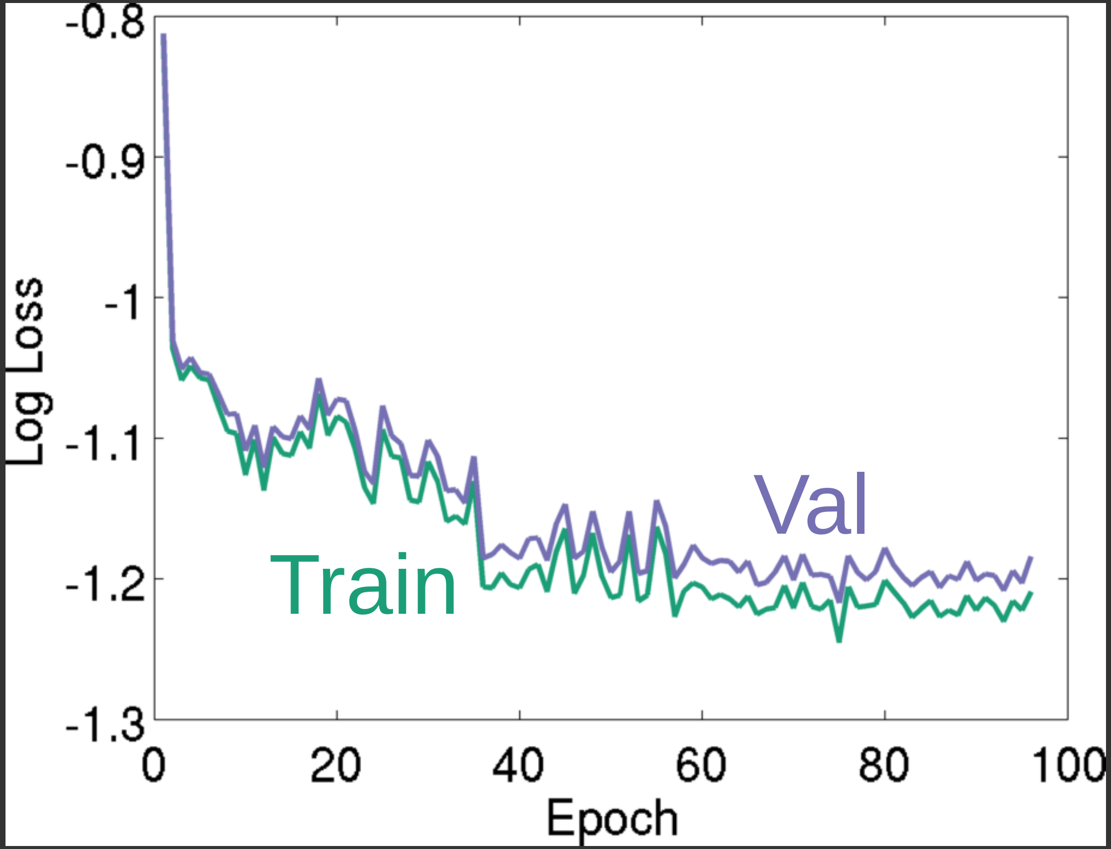
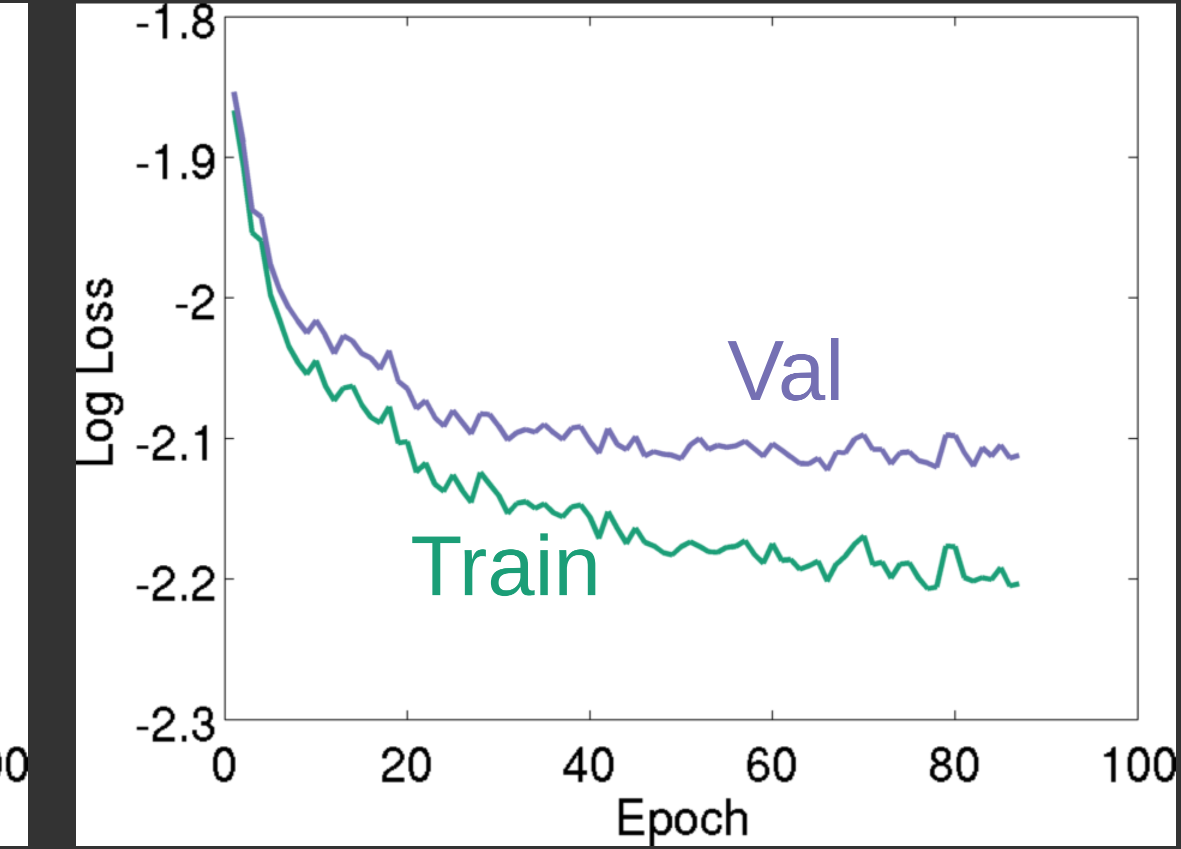
Training QC

Reasonable

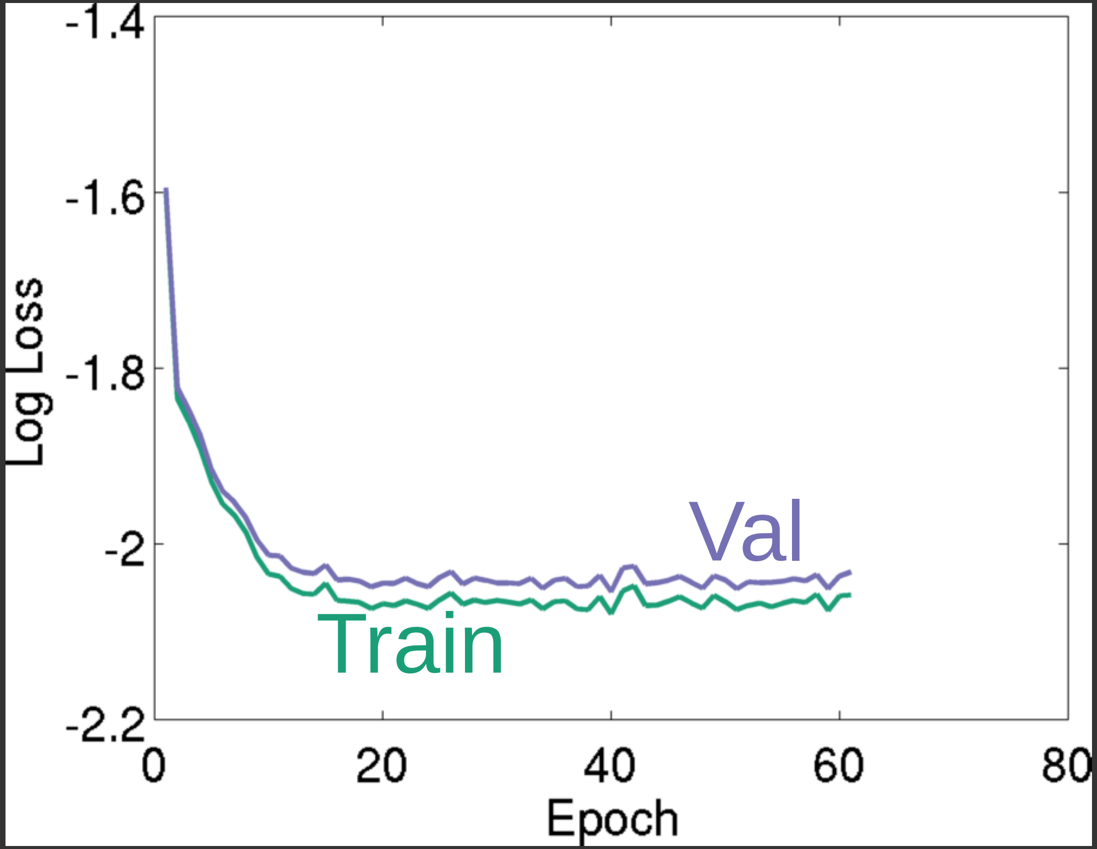


Overfitting

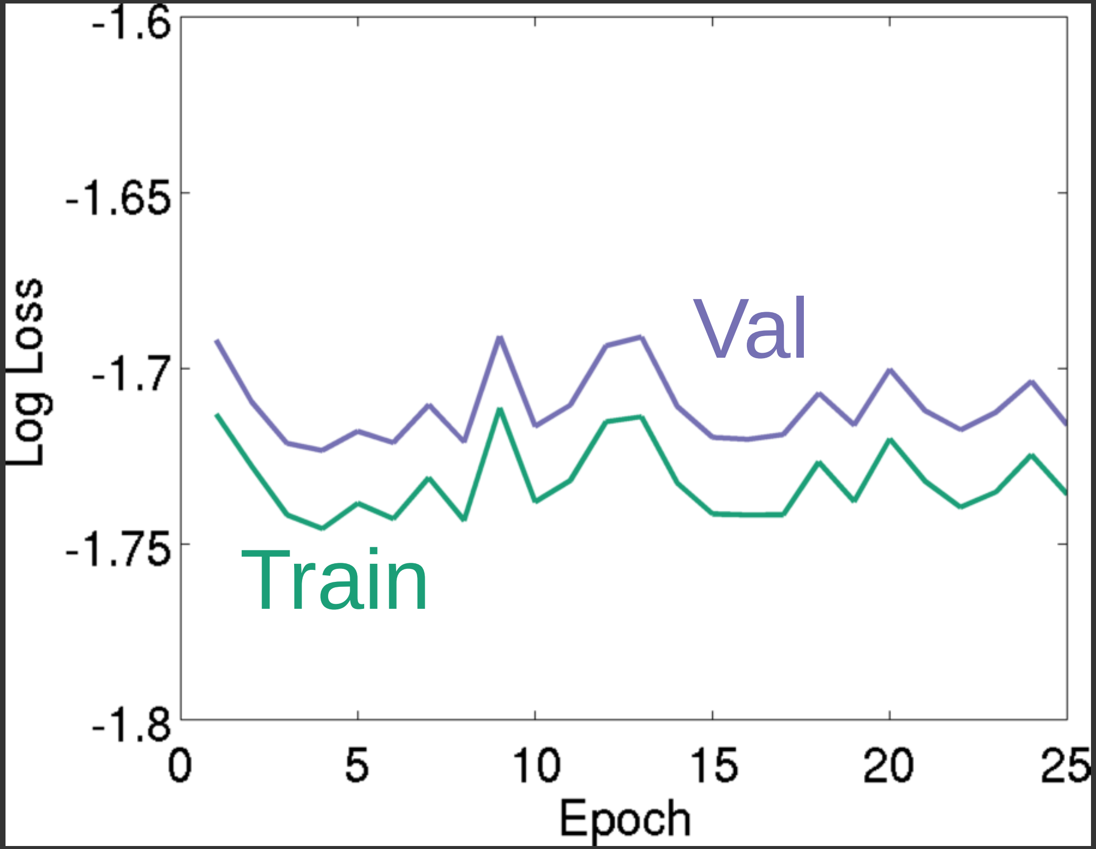


Training QC

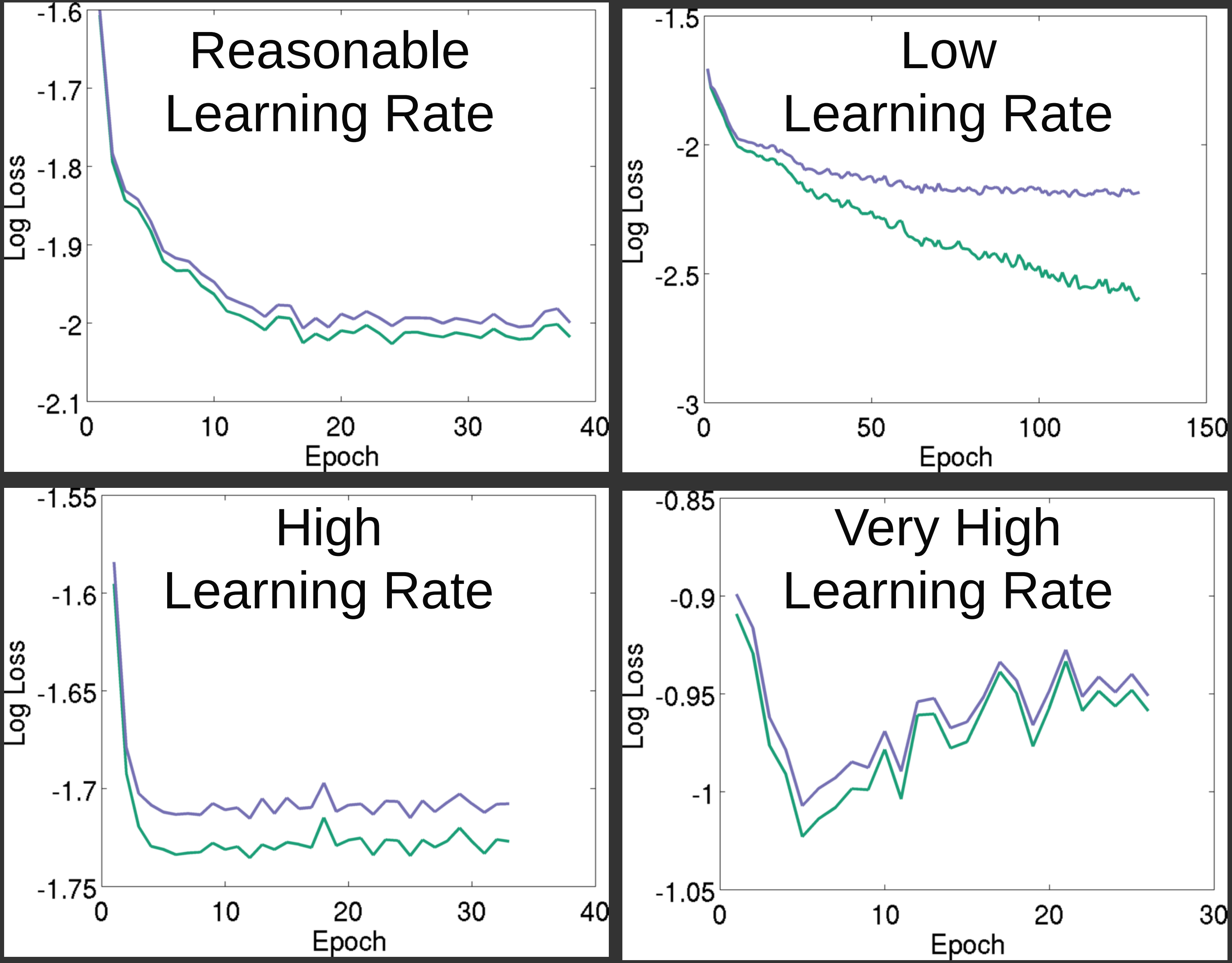
Reasonable



Underfitting (Bias)



Training QC


Reasonable Learning Rate
Log Loss
-1.6
-1.7
-1.8
-1.9
-2
-2.1
0
10
20
30
40
Epoch
Low Learning Rate
Log Loss
-1.5
-2
-2.5
-3
0
50
100
150
Epoch
High Learning Rate
Log Loss
-1.55
-1.6
-1.65
-1.7
-1.75
0
10
20
30
40
Epoch
Very High Learning Rate
Log Loss
-0.85
-0.9
-0.95
-1
-1.05
0
10
20
30
Epoch

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Example Test Data

Location: test_data/