Meeting 22/04/22

Outline

LSTM model

- PR input sequence
- PR output sequence

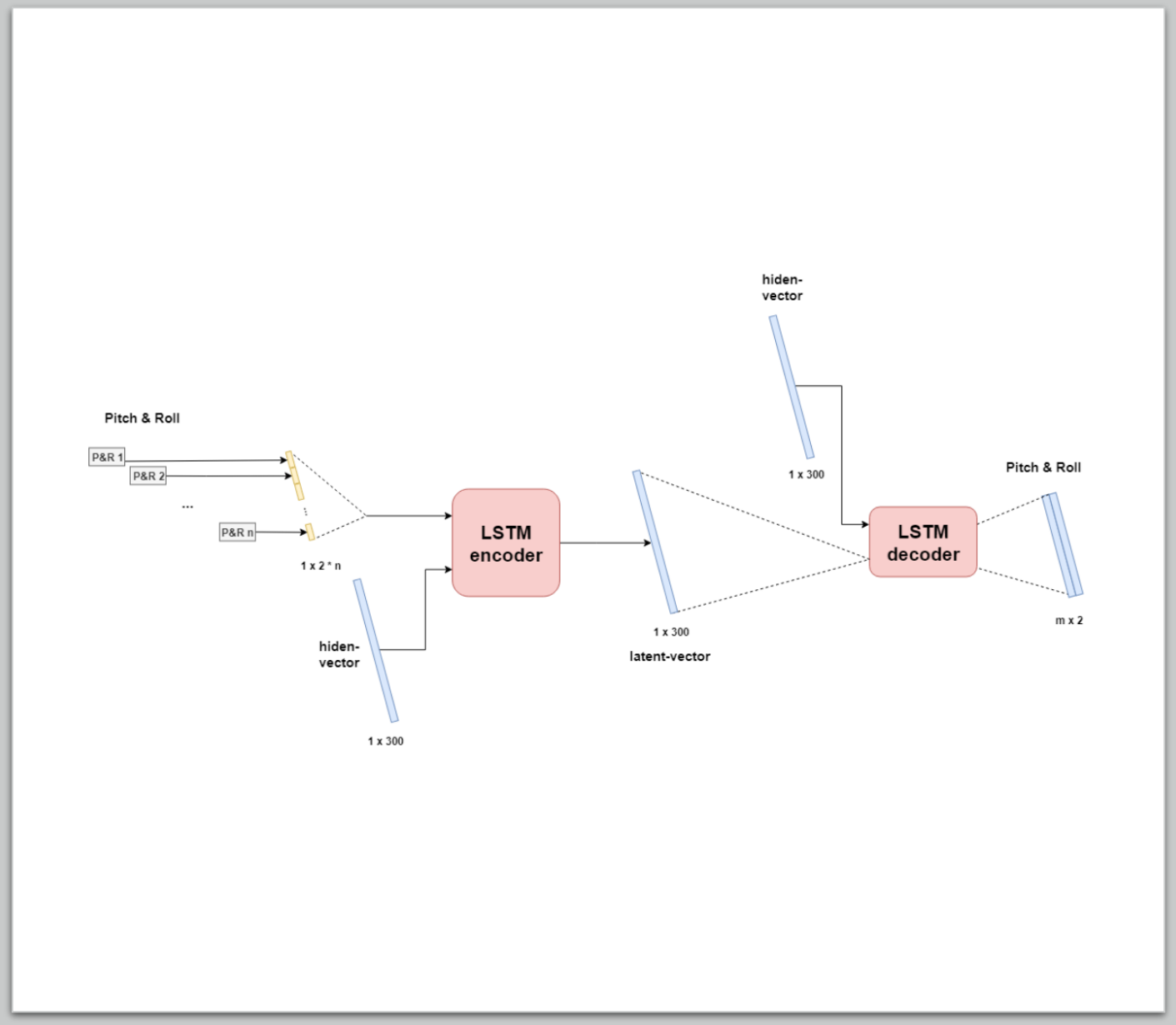
CNN LSTM hybrid model

- Image input sequence
- PR output sequence

LSTM PR sequence

LSTM PR sequence

- Encoder decoder LSTM network
- Architecture:
  - LSTM encoder:
    - Processes input sequence
    - Hidden size = 300
  - LSTM decoder:
    - Processes output from encoder
    - Hidden size = 300
    - Outputs PR sequence



Training

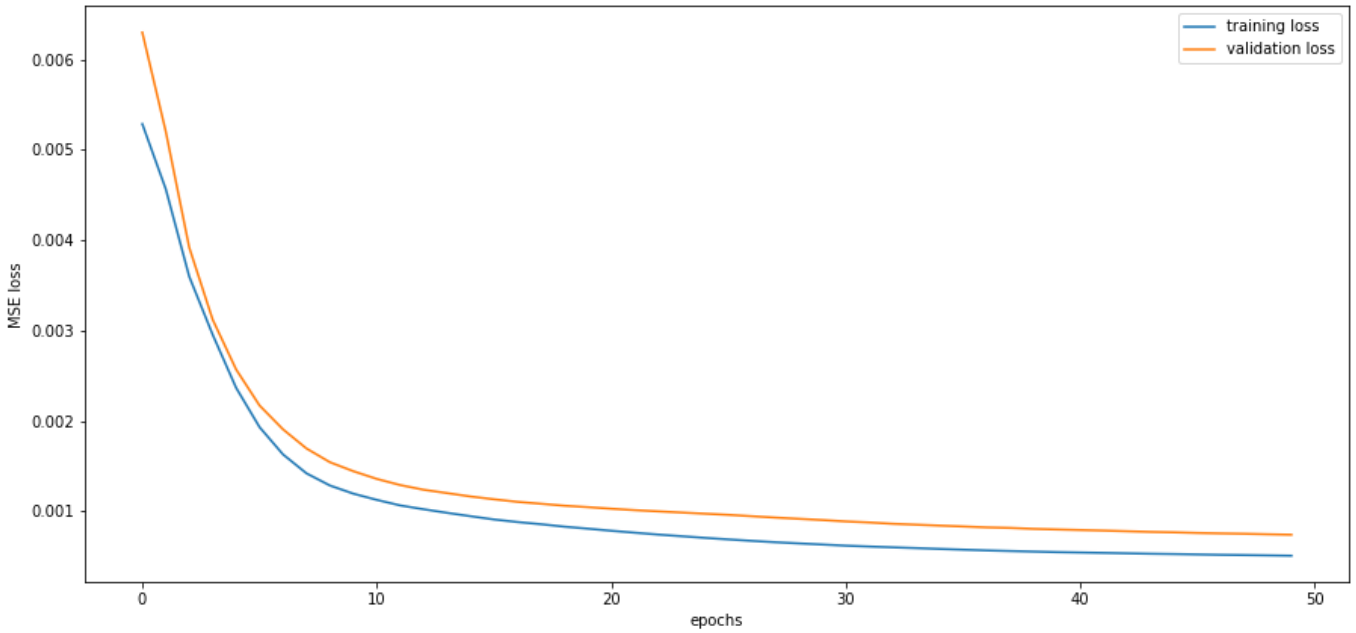
- Train, test, validation: 80, 10, 10
- Trained for 50 epochs
- Batch size 64
- Learning rate of 0,001

I/O-sequence (2fps)

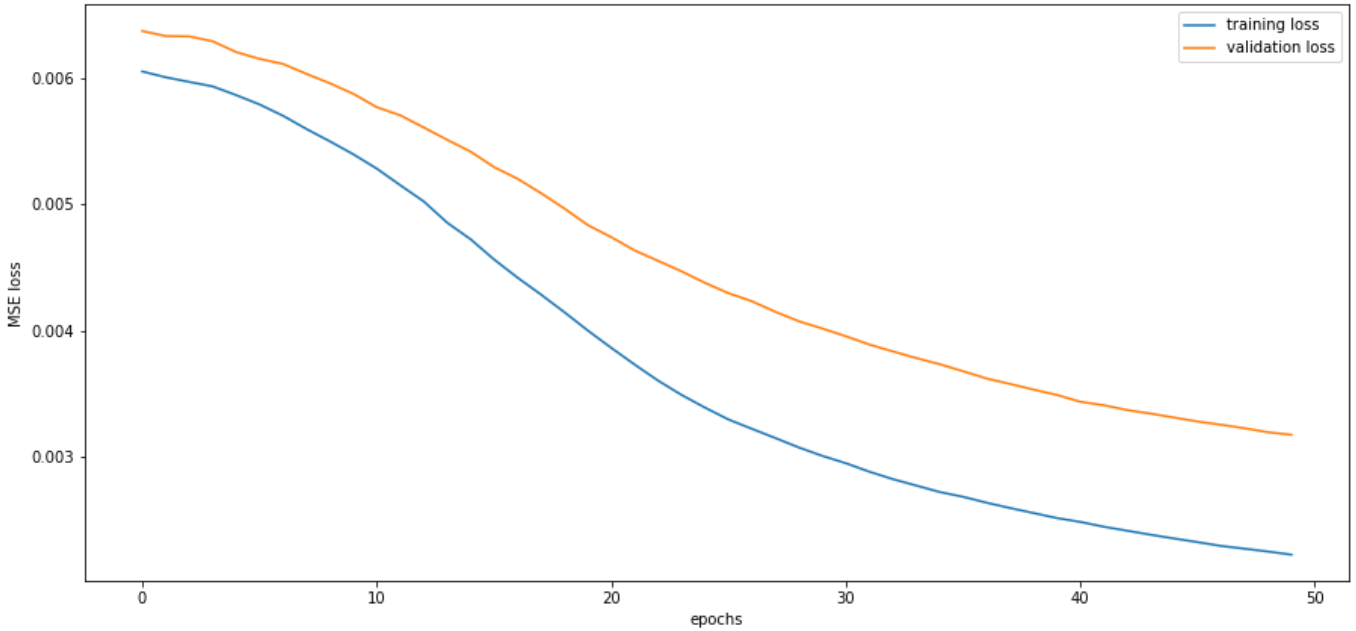
- 60/60 frames
- 10/60 frames

Training results

- 60/60 (top)
  - Good convergence

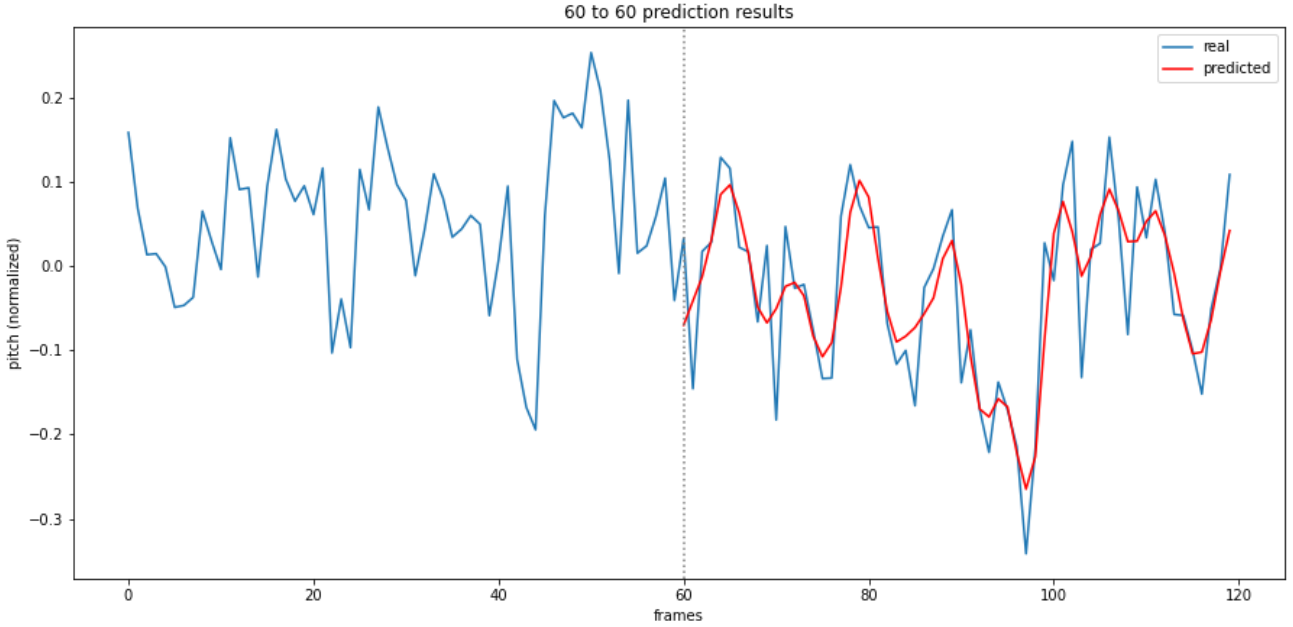


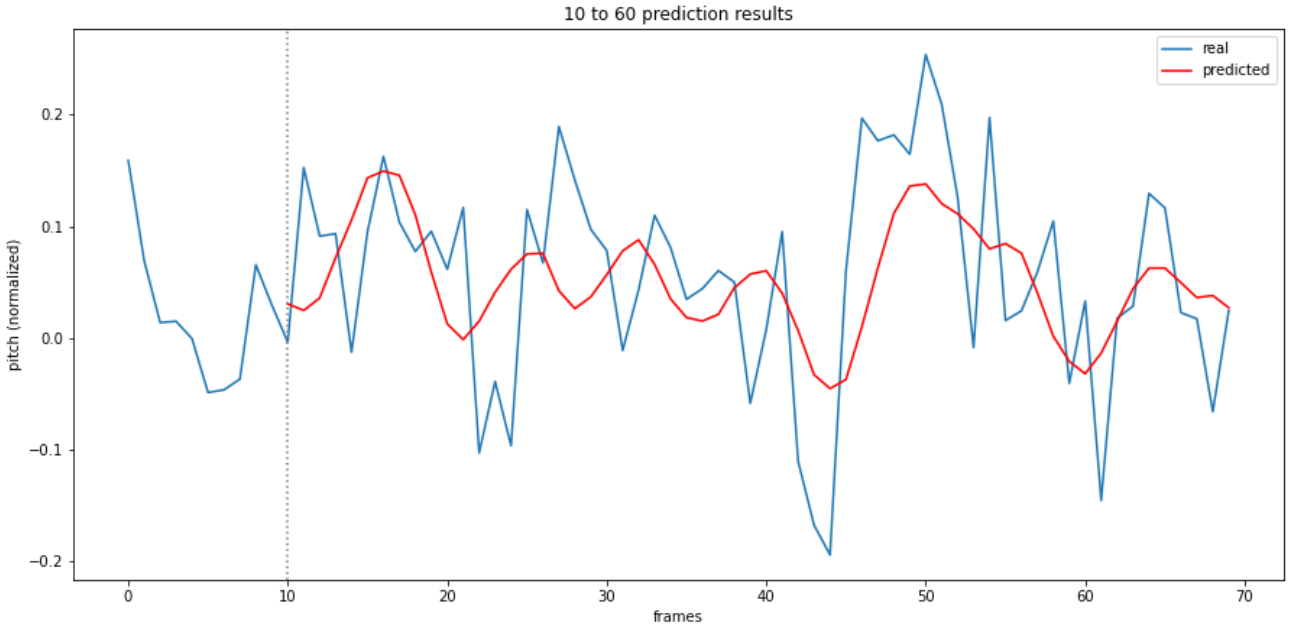
- 10/60 (bottom)
  - Poor convergence



Prediction results: Pitch

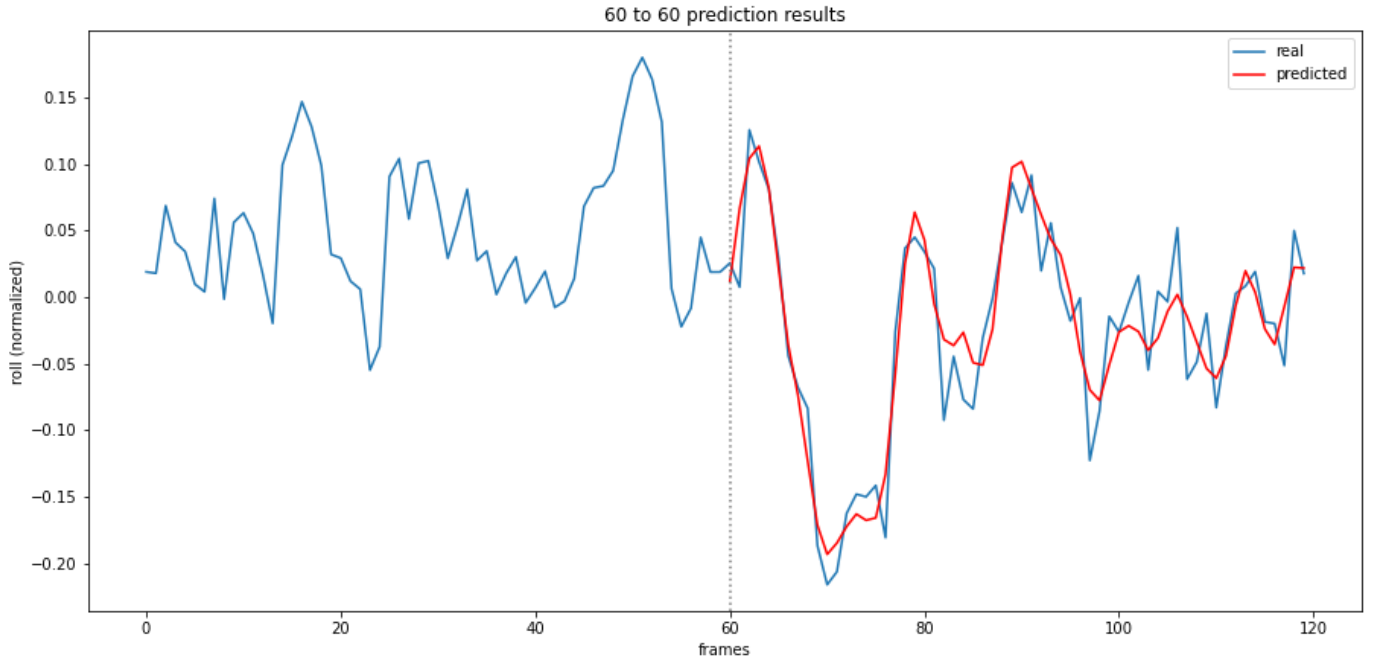
- 60/60 (top)
  - Good convergence
- 10/60 (bottom)
  - Poor convergence

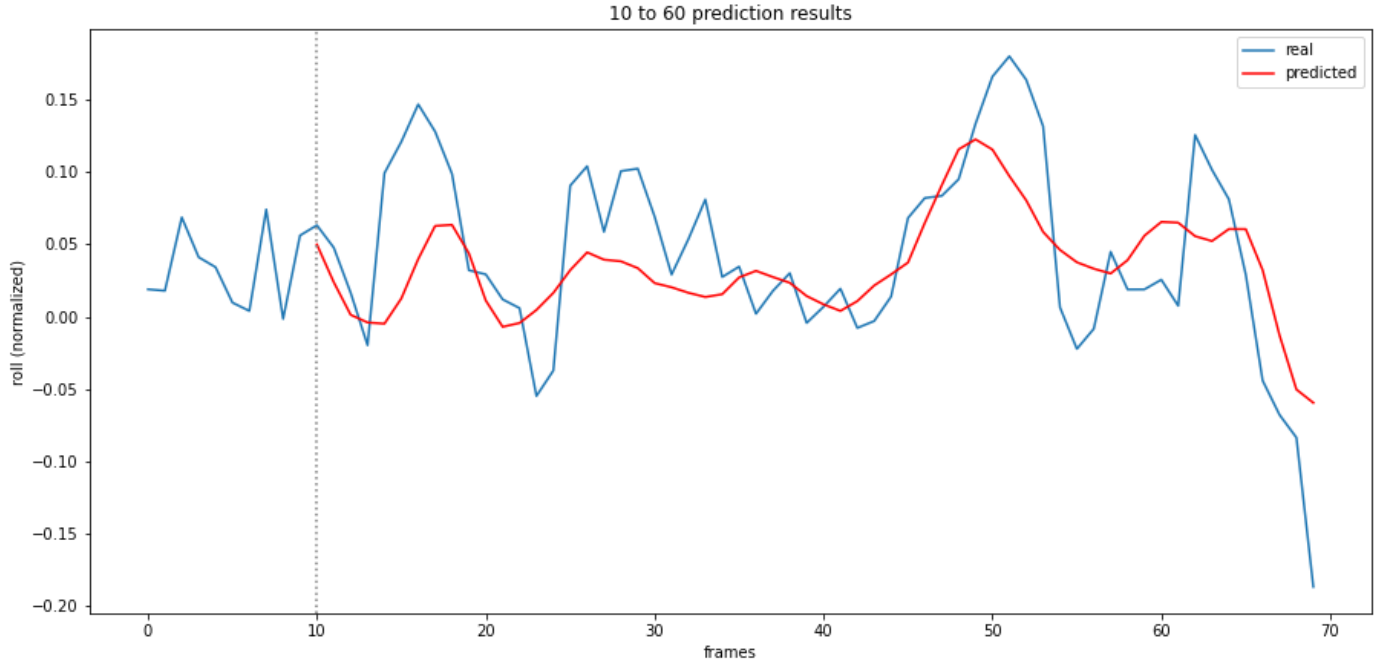




Prediction results: Roll

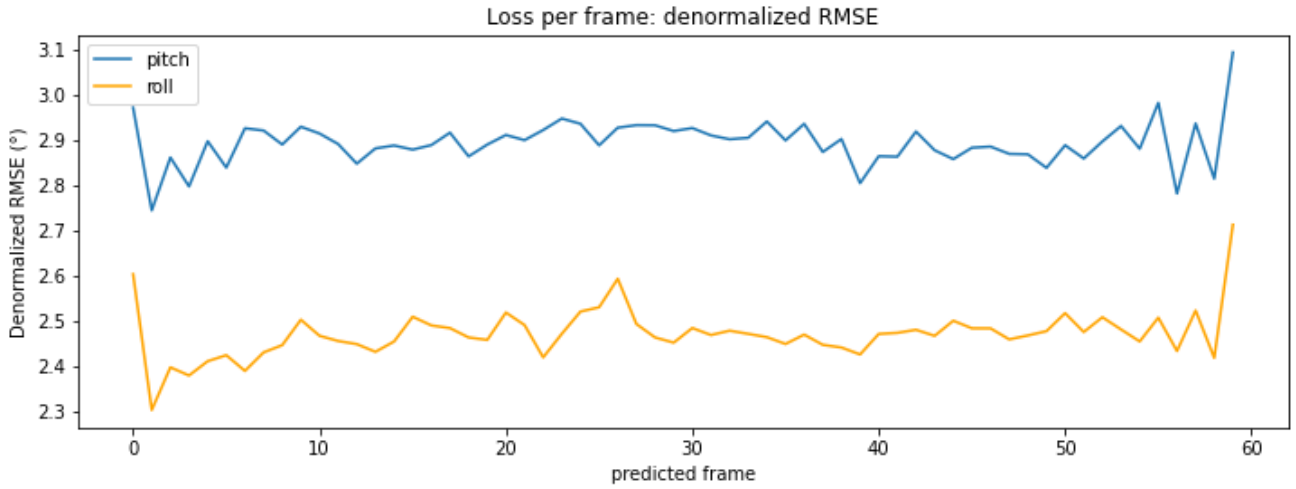
- 60/60 (top)
  - Good convergence
- 10/60 (bottom)
  - Poor convergence



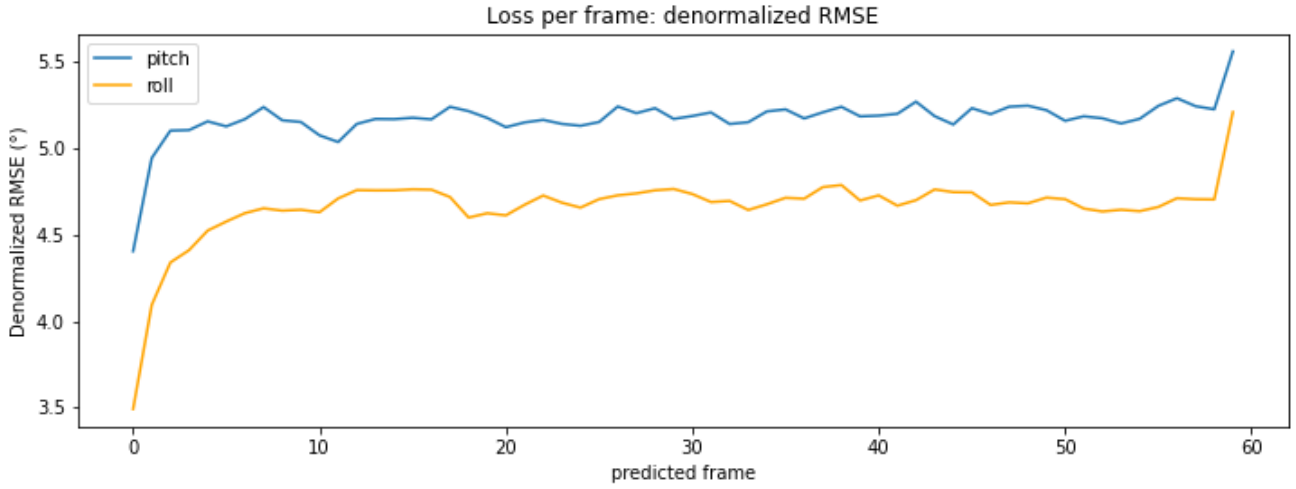


Loss per frame

- 60/60 (top)
  - Good convergence
  - LPF < 3,1°



- 10/60 (bottom)
  - Poor convergence
  - LPF < 5,5°



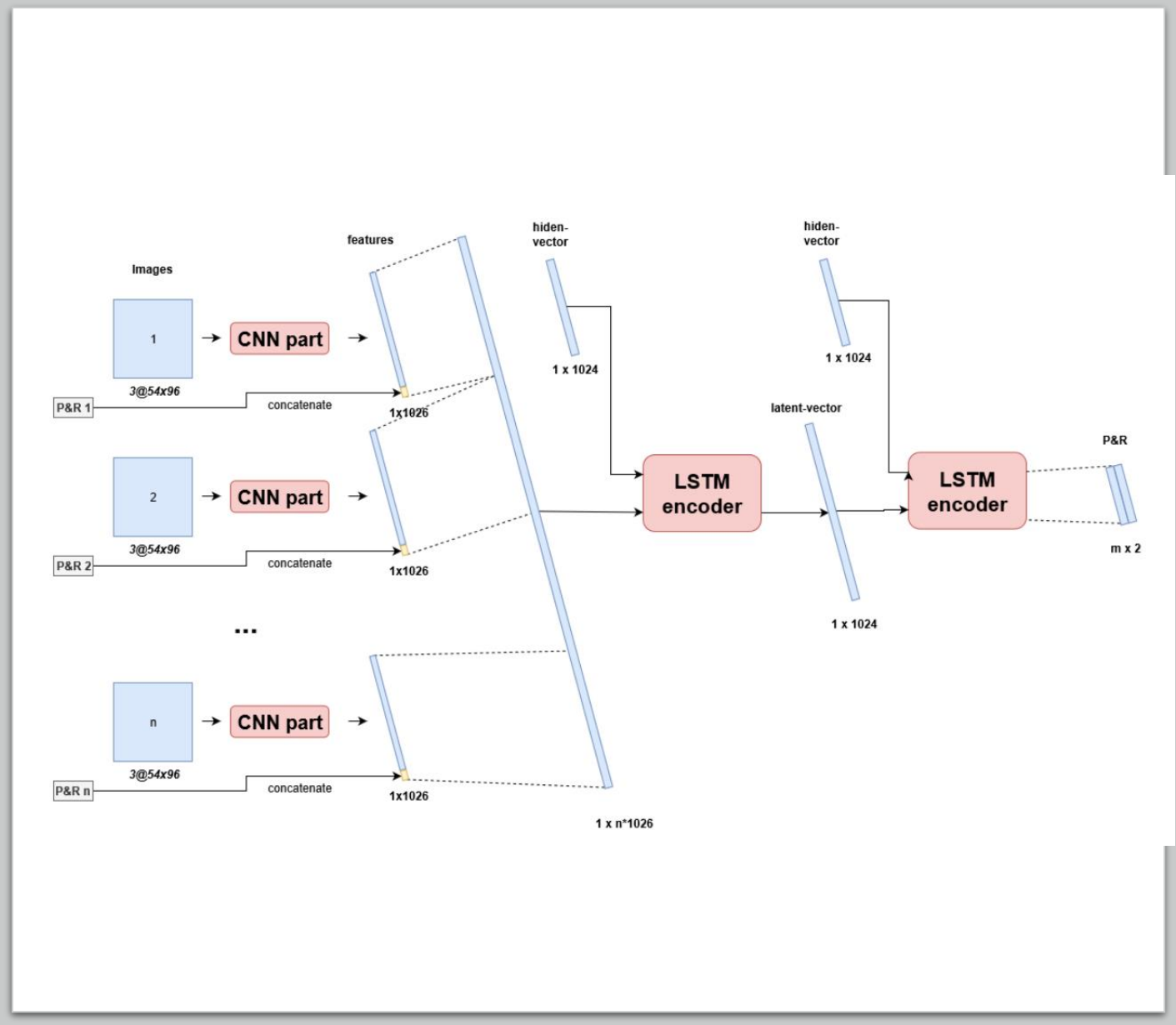
LSTM results

MODEL	Avg. PITCH error (°)	Avg. ROLL error (°)
60/60 LSTM	2.23°	1.96°
60/60 Zero	6.44°	7.27°
10/60 LSTM	5.18°	4.66°
10/60 Zero	6.33°	7.43°

CNN LSTM

LSTM PR sequence

- CNN Encoder decoder LSTM network
- Architecture:
  - CNN feature extraction
  - LSTM encoder:
    - Processes feature vector
    - Hidden size = 1024
  - LSTM decoder:
    - Processes output from encoder
    - Hidden size = 1024
    - Outputs PR sequence



Training

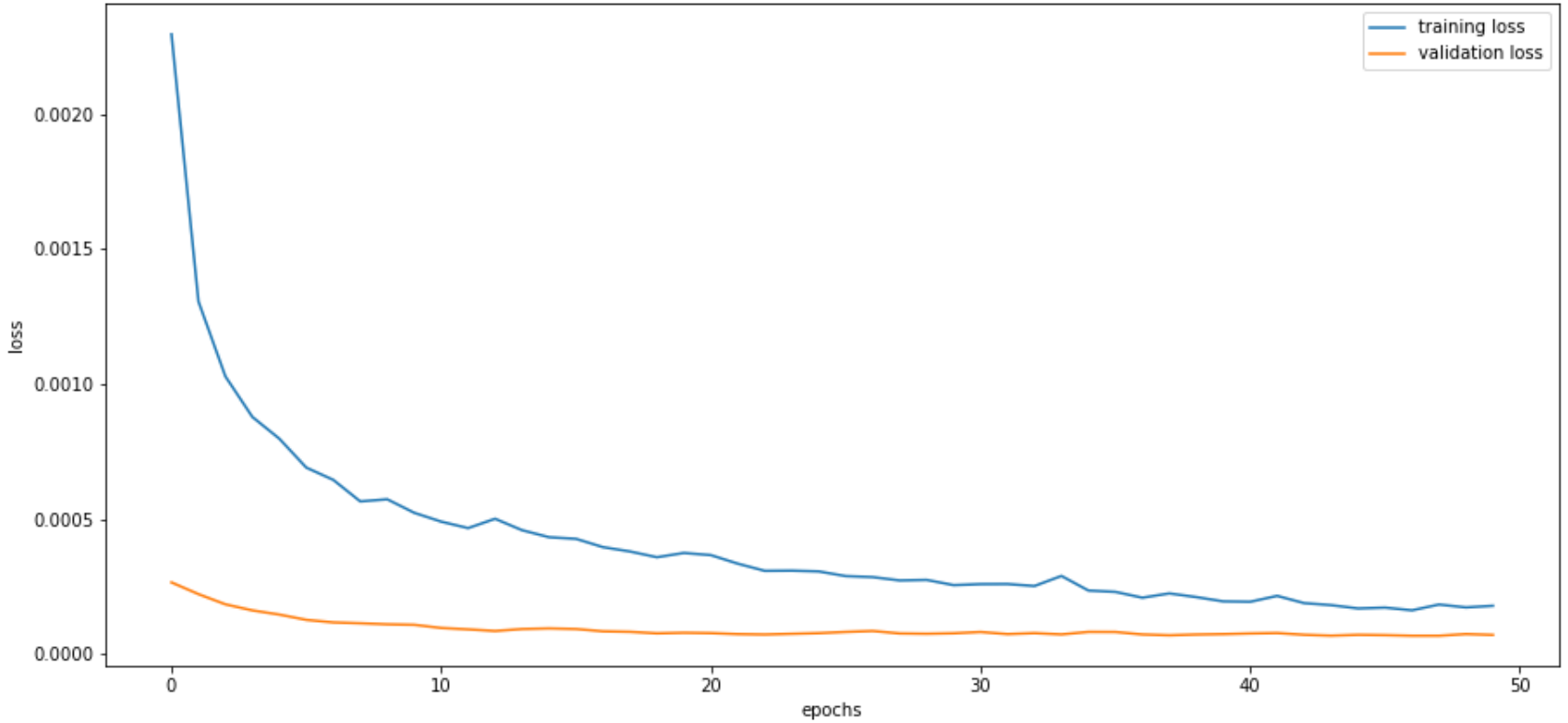
- Train, test, validation: 80, 10, 10
- Trained for 50 epochs
- Batch size 64
- Learning rate of 0,001

I/O-sequence (2fps)

- 10/60 frames

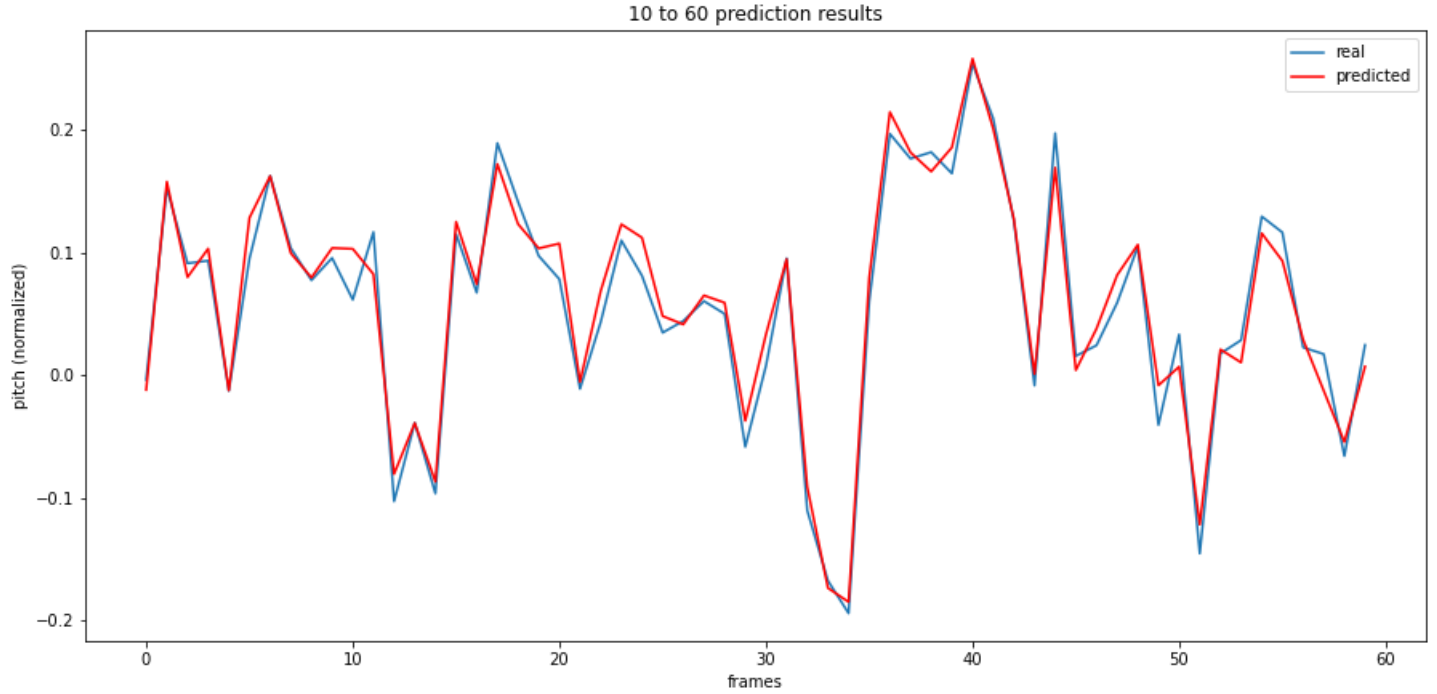
Training results

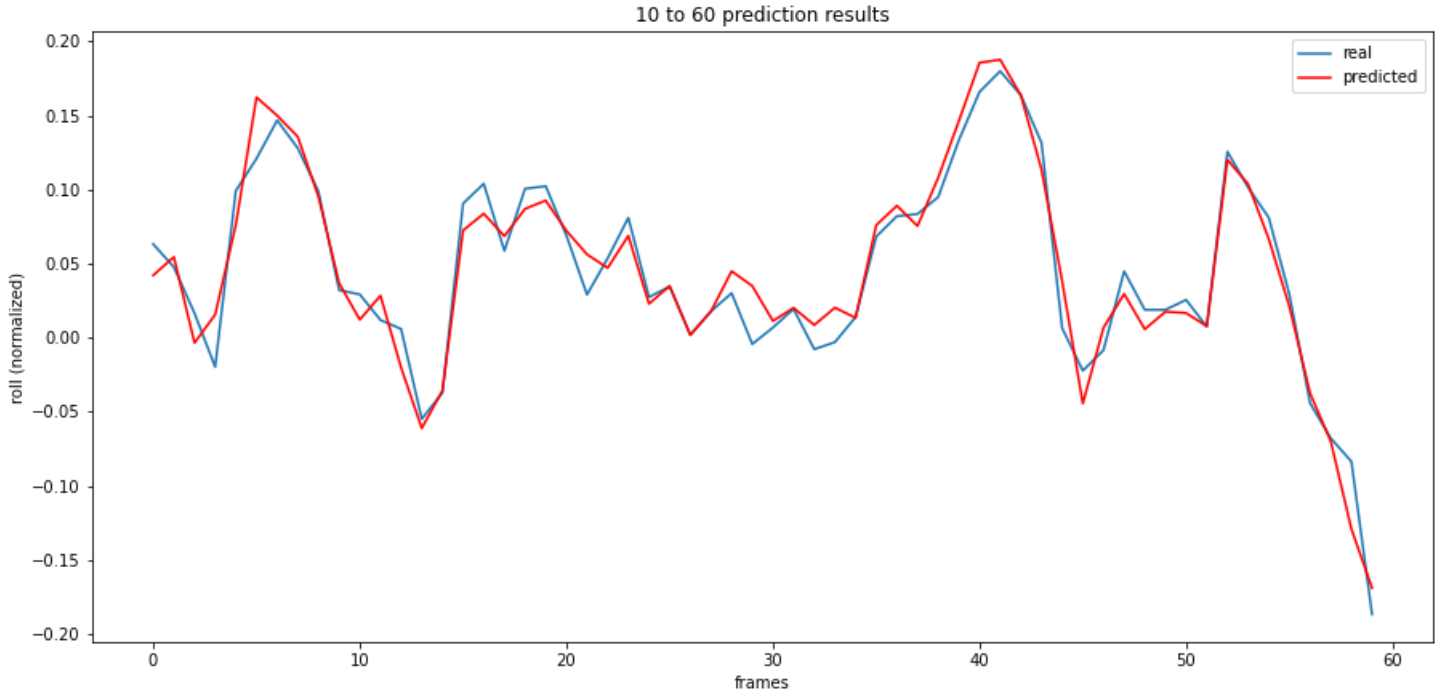
- 10/60 (top)
  - Good convergence
  - Low validation loss



Prediction results

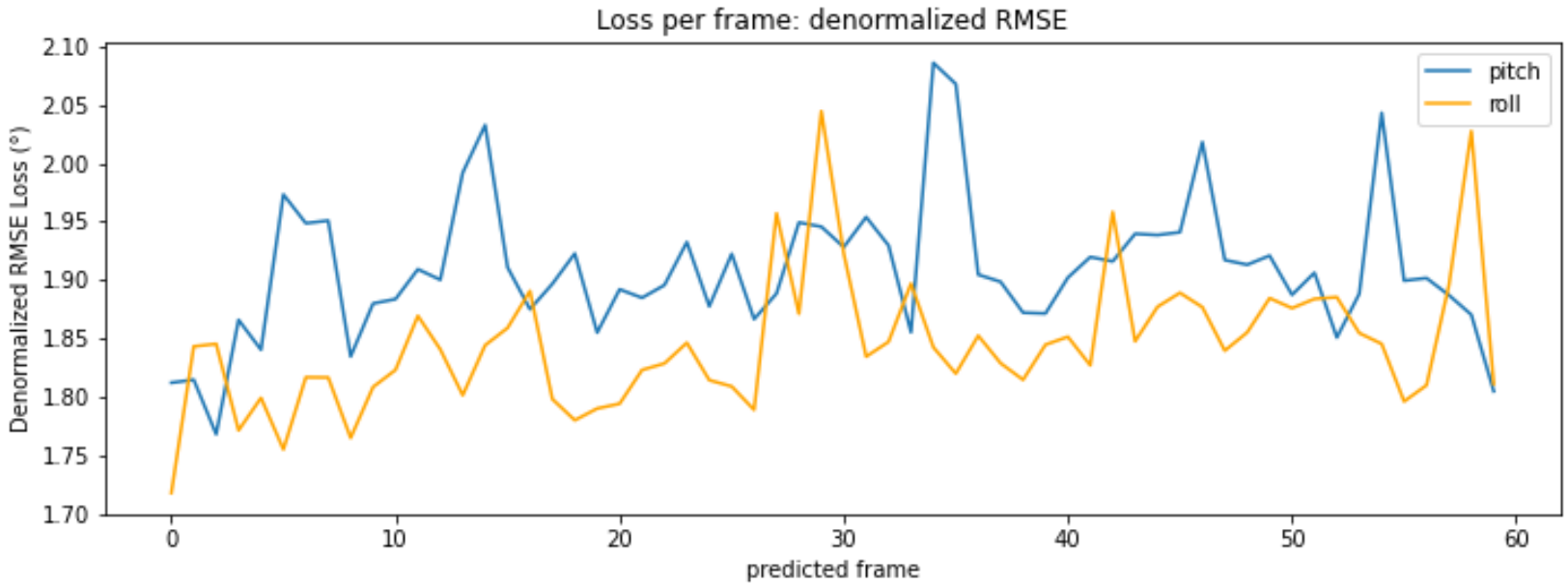
- 10/60 pitch (top)
- 10/60 roll (bottom)





Loss per frame

- 10/60 RMSE
  - LPF < 2,1°



CNN LSTM pitch

Pitch prediction

MSE: 0.00028

RMSE: 0.0168

RMSE denorm: 1.51°

Zero prediction

MSE 0: 0.00518

RMSE 0: 0.072

RMSE denorm: 6.48°

Improvement on zero prediction:

MSE delta%: 1850.0 %

RMSE delta%: 428.57 %

CNN LSTM roll

Roll prediction

MSE: 0.00026

RMSE: 0.0162

RMSE denorm: 1.46°

Zero prediction

MSE 0: 0.00616

RMSE 0: 0.0785

RMSE denorm: 7.06°

Improvement on zero prediction:

MSE delta%: 2369.23 %

RMSE delta%: 484.57 %

Results

MODEL (input/output)	Avg. PITCH error (°)	Avg. ROLL error (°)
60/60 LSTM	2.23°	1.96°
10/60 LSTM	5.18°	4.66°
10/60 CNN-LSTM	1.51°	1.46°
10/60 Zero	6.33°	7.43°

To Do

- Inference time comparison
- Double check calculations
- Add PR to input
- New datasets: real and simulated