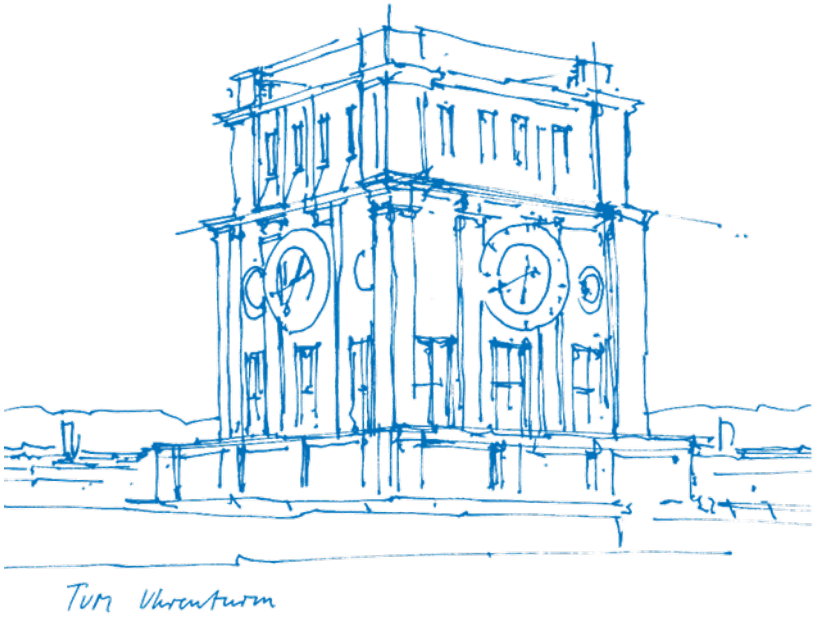
Deep Learning Methods for Reynolds-Averaged Navier-Stokes Simulations of Airfoil Flows



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Technical University of Munich
Chair of Computer Graphics and Visualization
Munich, 11. May 2020

Introduction

TODO

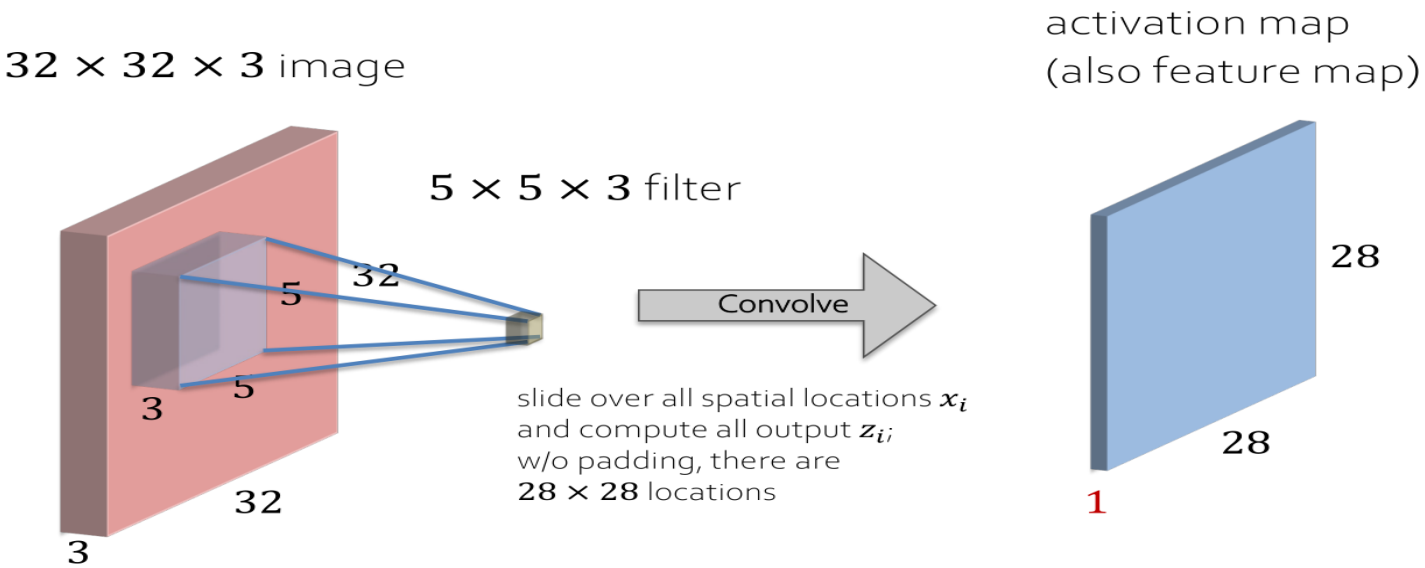
Background – RANS

TODO

Background – RANS

TODO

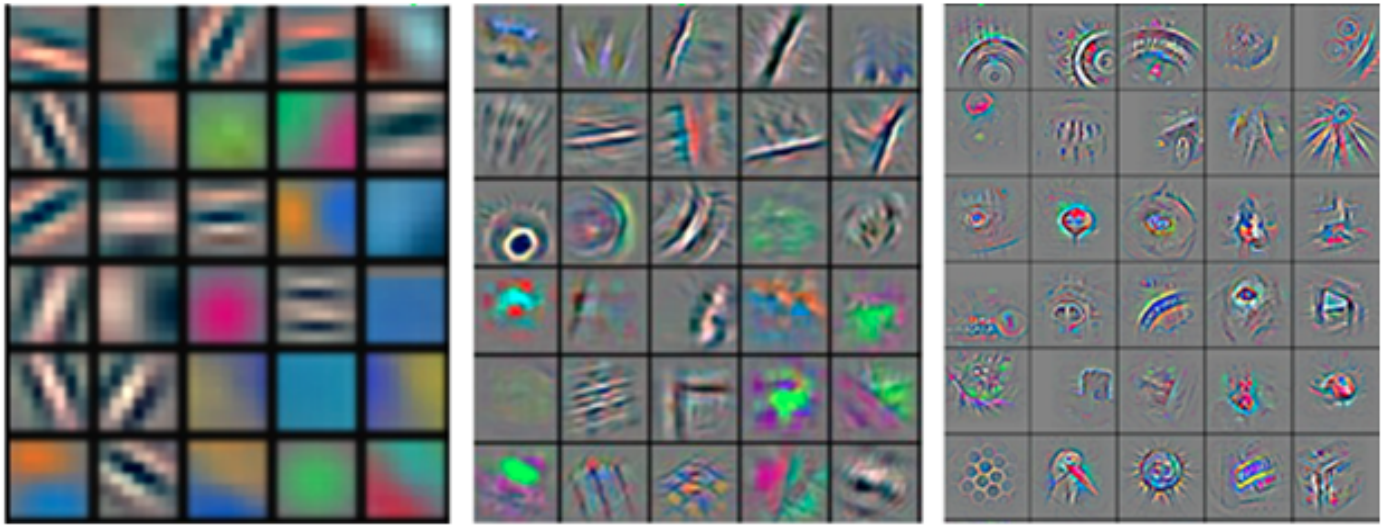
Background – Convolutions



Taken from I2DL WS19/20 (TUM)

Background – Convolutions

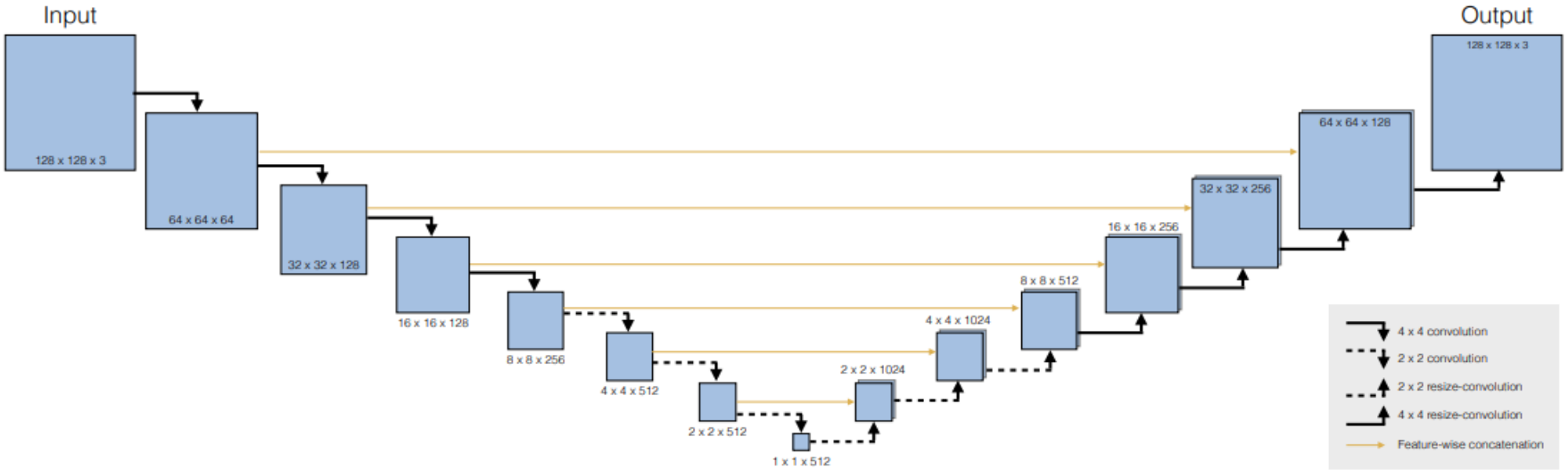
Low-Level Features, Mid-Level Features, High-Level Features: each filter captures different characteristics



Taken from `https://arxiv.org/pdf/1311.2901.pdf`

Architecture

U-Net derivative proposed in the paper:



Taken from `https://arxiv.org/pdf/1810.08217.pdf`

Architecture

Convolutional blocks:

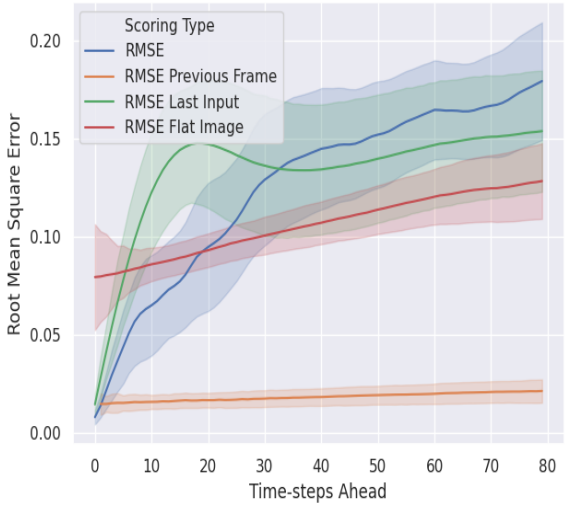
TODO

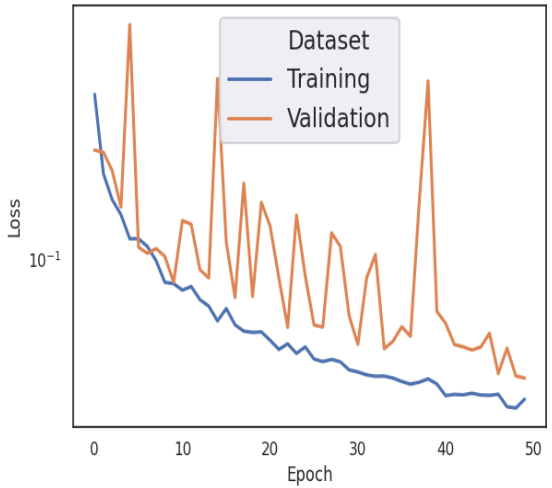
Pre-processing

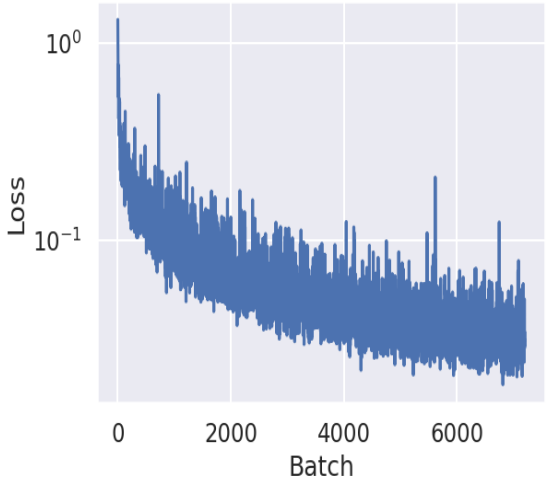
TODO

Transfer

RMSE with variance, validation loss and batch loss on Bigger Tub environment:





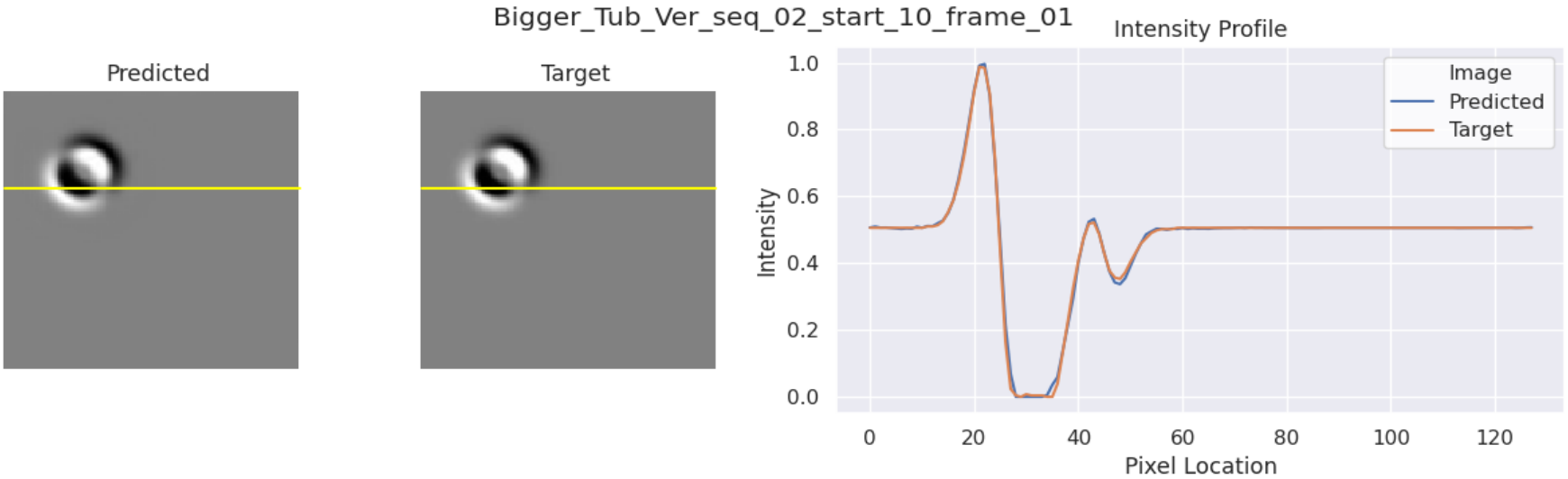


All plots in Transfer were made with `https://github.com/stathius/wave_propagation`

Transfer

Wave propagation prediction

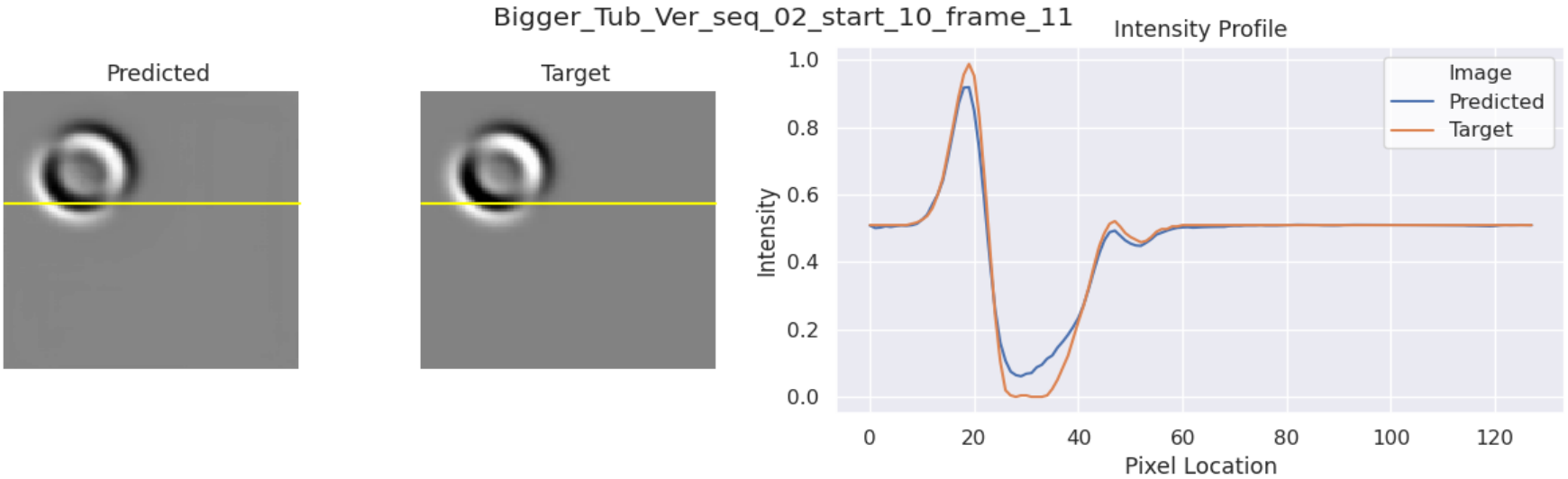
Intensity profile on scanline – Frame 1



Transfer

Wave propagation prediction

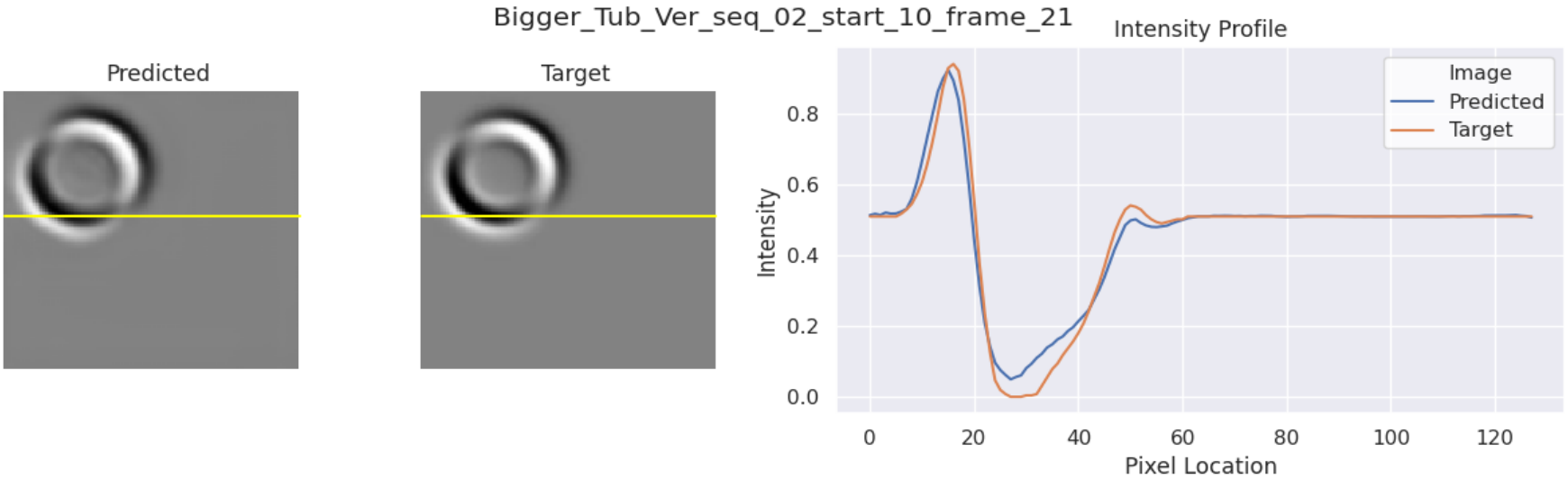
Intensity profile on scanline – Frame 11



Transfer

Wave propagation prediction

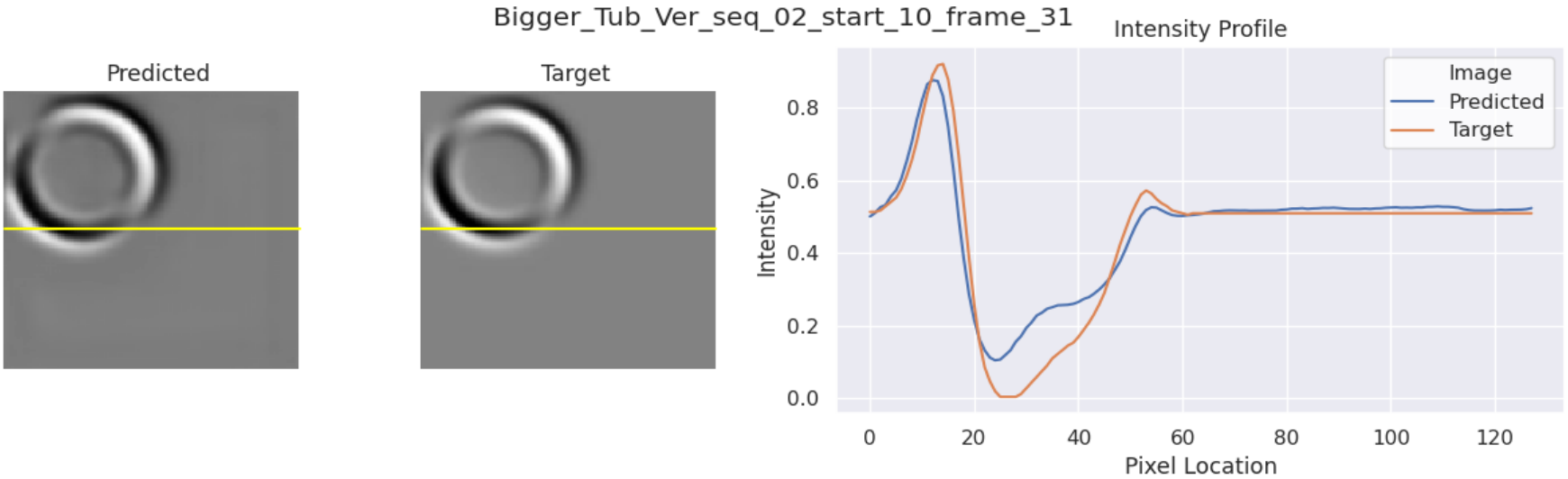
Intensity profile on scanline – Frame 21



Transfer

Wave propagation prediction

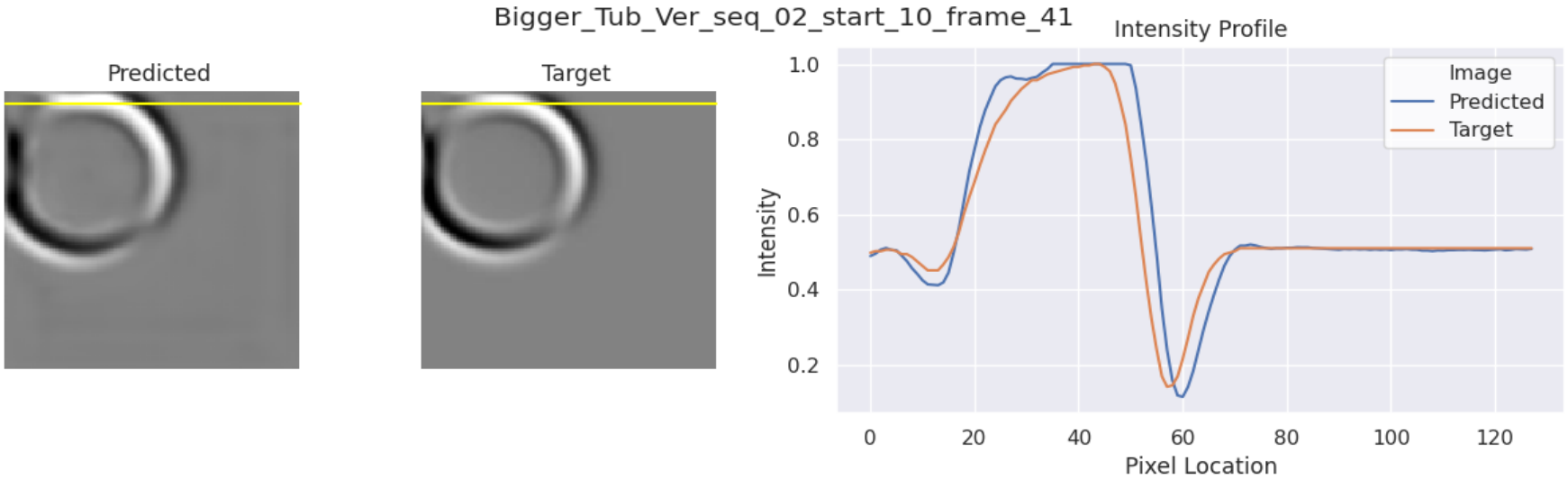
Intensity profile on scanline – Frame 31



Transfer

Wave propagation prediction

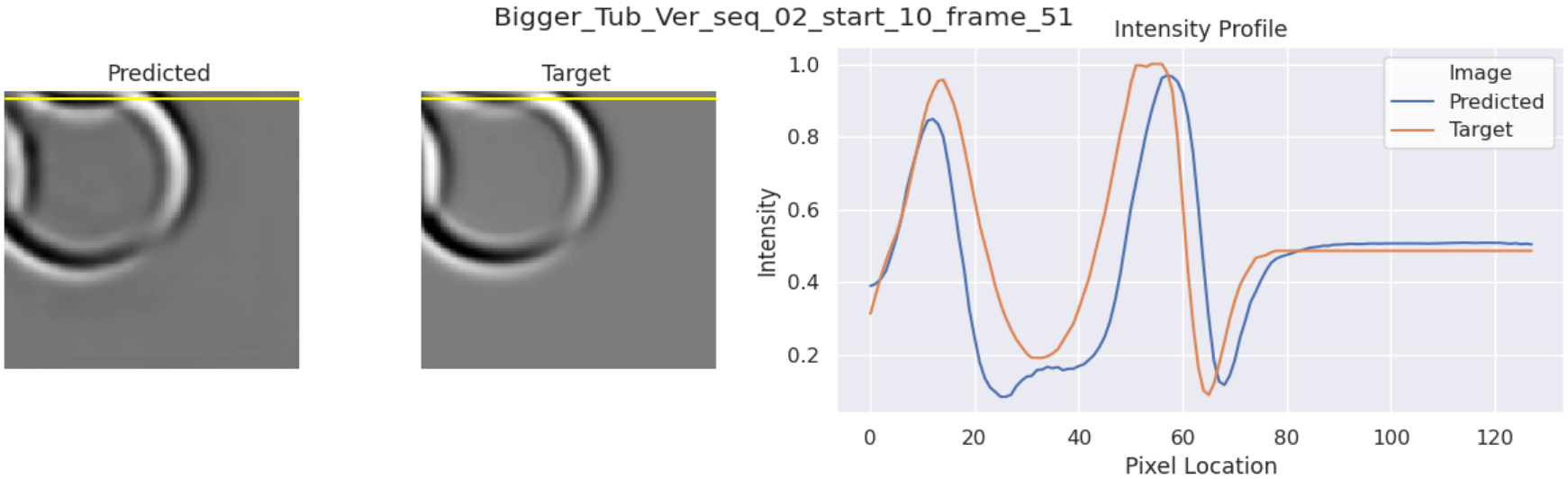
Intensity profile on scanline – Frame 41



Transfer

Wave propagation prediction

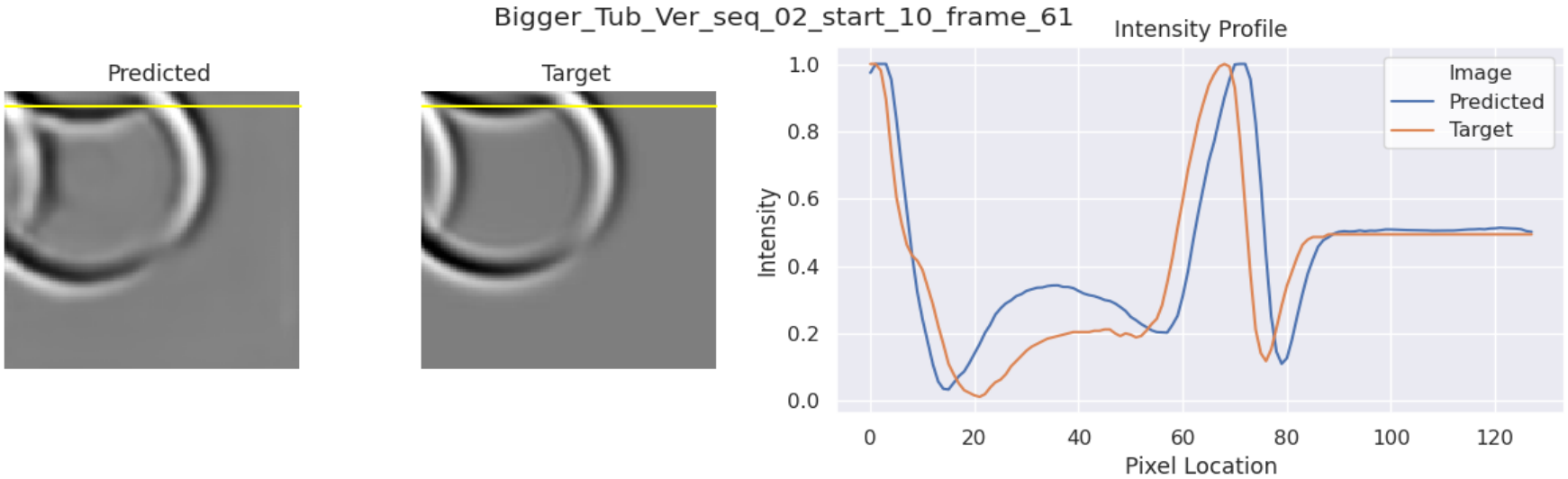
Intensity profile on scanline – Frame 51



Transfer

Wave propagation prediction

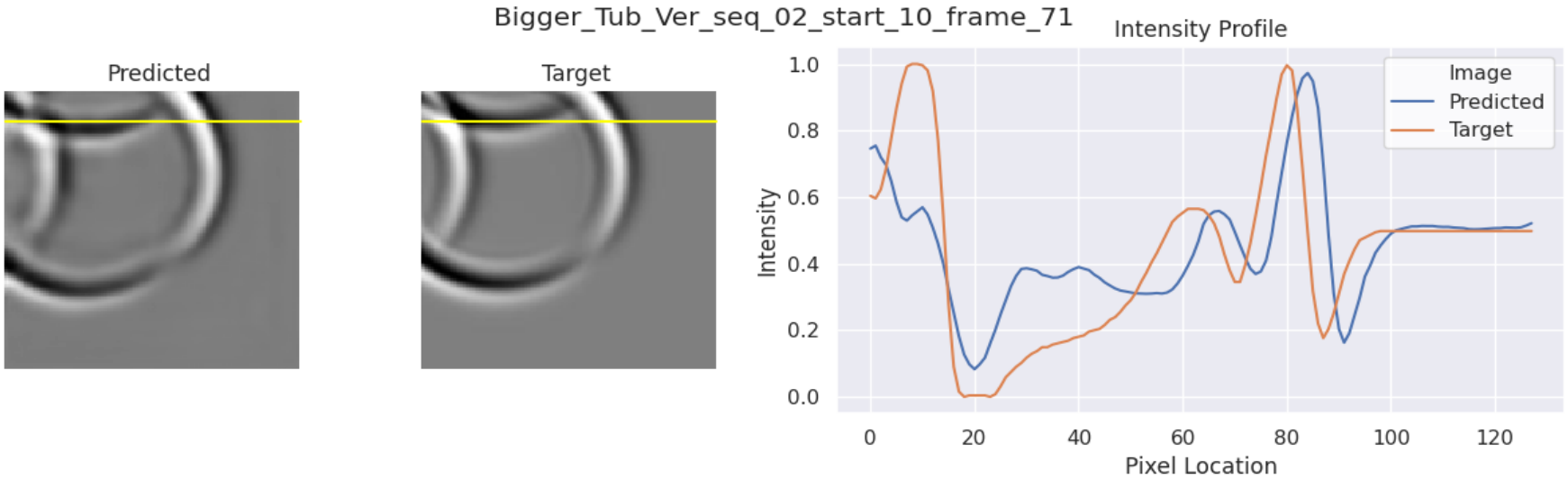
Intensity profile on scanline – Frame 61



Transfer

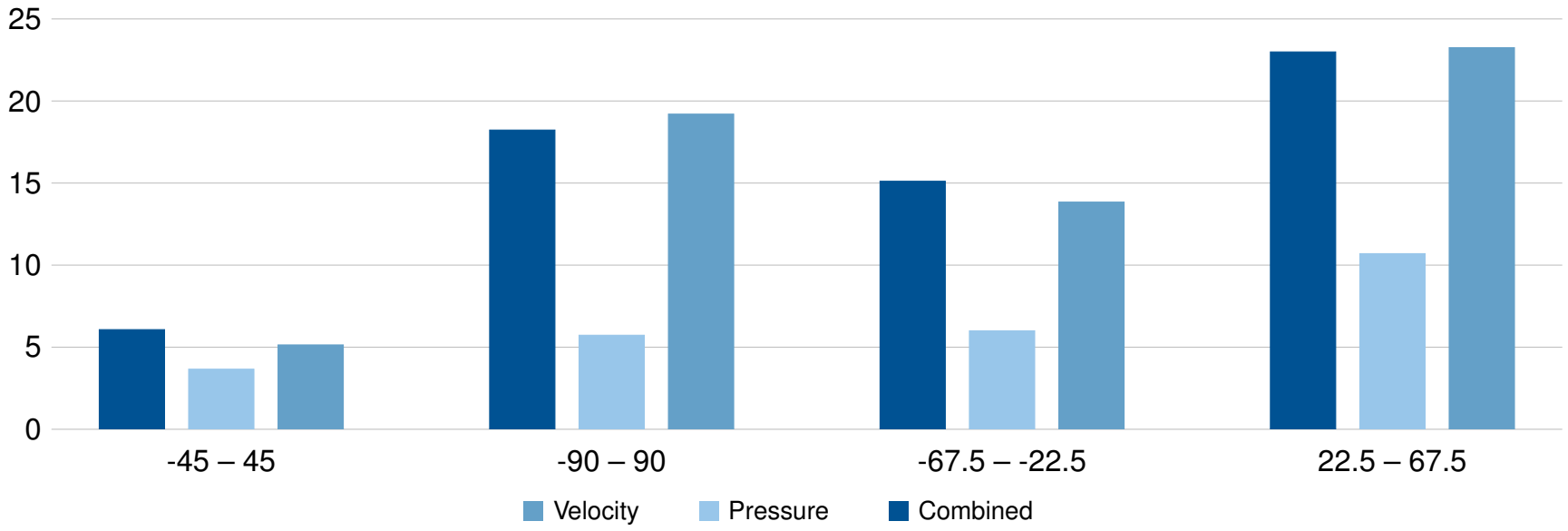
Wave propagation prediction

Intensity profile on scanline – Frame 71



Generalization

Error percentage of different angle of attack intervals wrt. ground truth $[-22.5, 22.5]$



Discussion

TODO