Paper structure outline

[1 Introduction 3](#_Toc103958731)

[1.1 Outline, existing situation 3](#_Toc103958732)

[1.2 Problem definition 3](#_Toc103958733)

[1.3 Objectives 3](#_Toc103958734)

[1.4 Structure of the paper 3](#_Toc103958735)

[2 Background and related work 3](#_Toc103958736)

[2.1 Ship motions in six degrees of freedom 3](#_Toc103958737)

[2.2 Ship motion prediction methods 3](#_Toc103958738)

[2.3 Neural networks 3](#_Toc103958739)

[2.4 Tools 3](#_Toc103958740)

[2.5 Summary 3](#_Toc103958741)

[3 Data 3](#_Toc103958742)

[3.1 Simulated data 3](#_Toc103958743)

[3.2 Real data 3](#_Toc103958744)

[3.2.1 ASV sensor 3](#_Toc103958745)

[3.3 Data pre-processing 3](#_Toc103958746)

[3.3.1 Data cleansing 3](#_Toc103958747)

[3.3.2 Data formatting 3](#_Toc103958748)

[3.3.3 Data reduction 3](#_Toc103958749)

[3.3.4 Data normalization 3](#_Toc103958750)

[3.4 Data analysis 3](#_Toc103958751)

[3.4.1 Statistical properties 3](#_Toc103958752)

[3.4.2 Correlation and interactions 3](#_Toc103958753)

[3.5 Data loading 3](#_Toc103958754)

[3.5.1 Sequence generation 3](#_Toc103958755)

[3.5.2 Train-test-validation split 3](#_Toc103958756)

[3.5.3 DataLoader and DataSet 3](#_Toc103958757)

[3.6 Summary 4](#_Toc103958758)

[4 Model designs 4](#_Toc103958759)

[4.1 Neural network architectures 4](#_Toc103958760)

[4.1.1 Linear layers 4](#_Toc103958761)

[4.1.2 Recurrent neural networks 4](#_Toc103958762)

[4.1.3 Convolutional neural networks 4](#_Toc103958763)

[4.1.4 Auto-encoders 4](#_Toc103958764)

[4.1.5 Activation functions 4](#_Toc103958765)

[4.2 Single step models 4](#_Toc103958766)

[4.2.1 Stacked single output LSTM 4](#_Toc103958767)

[4.2.2 Stacked multi output LSTM 4](#_Toc103958768)

[4.3 Multi step models 4](#_Toc103958769)

[4.3.1 Encoder decoder LSTM 4](#_Toc103958770)

[4.3.2 Linear CNN 4](#_Toc103958771)

[4.3.3 CNN LSTM single input 4](#_Toc103958772)

[4.3.4 CNN LSTM dual input 4](#_Toc103958773)

[4.4 Summary 4](#_Toc103958774)

[5 Testing environment 4](#_Toc103958775)

[5.1 Criteria and error metrics 4](#_Toc103958776)

[5.1.1 Gradient descent optimizer 4](#_Toc103958777)

[5.1.2 Loss functions 4](#_Toc103958778)

[5.1.3 Inference time 4](#_Toc103958779)

[5.2 Hyperparameters 4](#_Toc103958780)

[5.2.1 Hyperband optimization 4](#_Toc103958781)

[5.3 Summary 4](#_Toc103958782)

[6 Results 4](#_Toc103958783)

[6.1 Single step models 5](#_Toc103958784)

[6.2 Multi step models 5](#_Toc103958785)

[6.2.1 Numeric input models 5](#_Toc103958786)

[6.2.2 Image input models 5](#_Toc103958787)

[6.2.3 Dual input models 5](#_Toc103958788)

[6.3 Inference time 5](#_Toc103958789)

[6.4 Hyperband optimization 5](#_Toc103958790)

[7 Discussion 5](#_Toc103958791)

[7.1.1 Future work 5](#_Toc103958792)

[8 References 5](#_Toc103958793)

[9 Appendix 5](#_Toc103958794)

# Introduction

## Outline, existing situation

## Ship motions in six degrees of freedom

## Problem definition

## Objectives

## Structure of the paper

Which chapter will discuss what topics and how are they all related to each other

# Background and related work

Starts with chapter outline

## Ship motion prediction methods

## Neural networks

## Tools

## Summary

# Data

Starts with chapter outline

## Simulated data

## Real data

### ASV sensor

## Data pre-processing

### Data cleansing

### Data formatting

### Data reduction

### Data normalization

## Data analysis

### Statistical properties

### Correlation and interactions

## Data loading

### Sequence generation

### Train-test-validation split

### DataLoader and DataSet

## Summary

# Model designs

Starts with chapter outline

## Neural network architectures

### Linear layers

### Recurrent neural networks

### Convolutional neural networks

### Auto-encoders

### Activation functions

## Single step models

### Stacked single output LSTM

### Stacked multi output LSTM

## Multi step models

### Encoder decoder LSTM

### Linear CNN

### CNN LSTM single input

### CNN LSTM dual input

## Summary

# Testing environment

Starts with chapter outline

## Criteria and error metrics

### Gradient descent optimizer

### Loss functions

### Inference time

## Hyperparameters

### Hyperband optimization

## Summary

# Results

Starts with chapter outline

## Single step models

## Multi step models

### Numeric input models

### Image input models

### Dual input models

## Inference time

## Hyperband optimization

# Discussion

### Future work

# References

# Appendix