# Optimization of Direct Speed Model Predict Control of Vehicle PMSM based on LSTM Network

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## Introduction

➤ This research paper presents a novel approach for optimizing the parameters of Direct Speed Model Predictive Control (DSMPC) for PMSM. The proposed methodology incorporates Long Short-Term Memory (LSTM) networks to evaluate the speed response of the PMSM and fuzzy logic-based perception labelling to capture the driver's perception as 'comfortable', 'fast', or 'disgusting'.
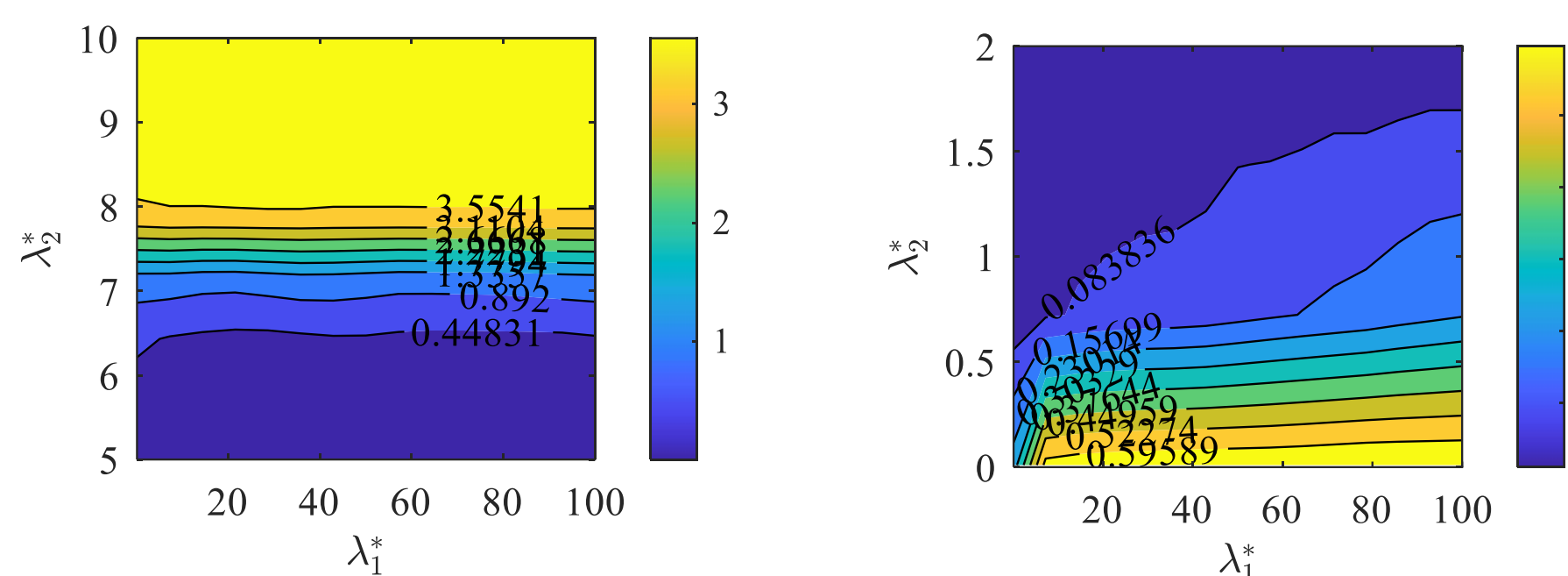
## Direct Speed Model Predict Control

The weighting parameters within DSMPC have a significant impact on control performance, particularly when dealing with variations in speed reference and load torque.
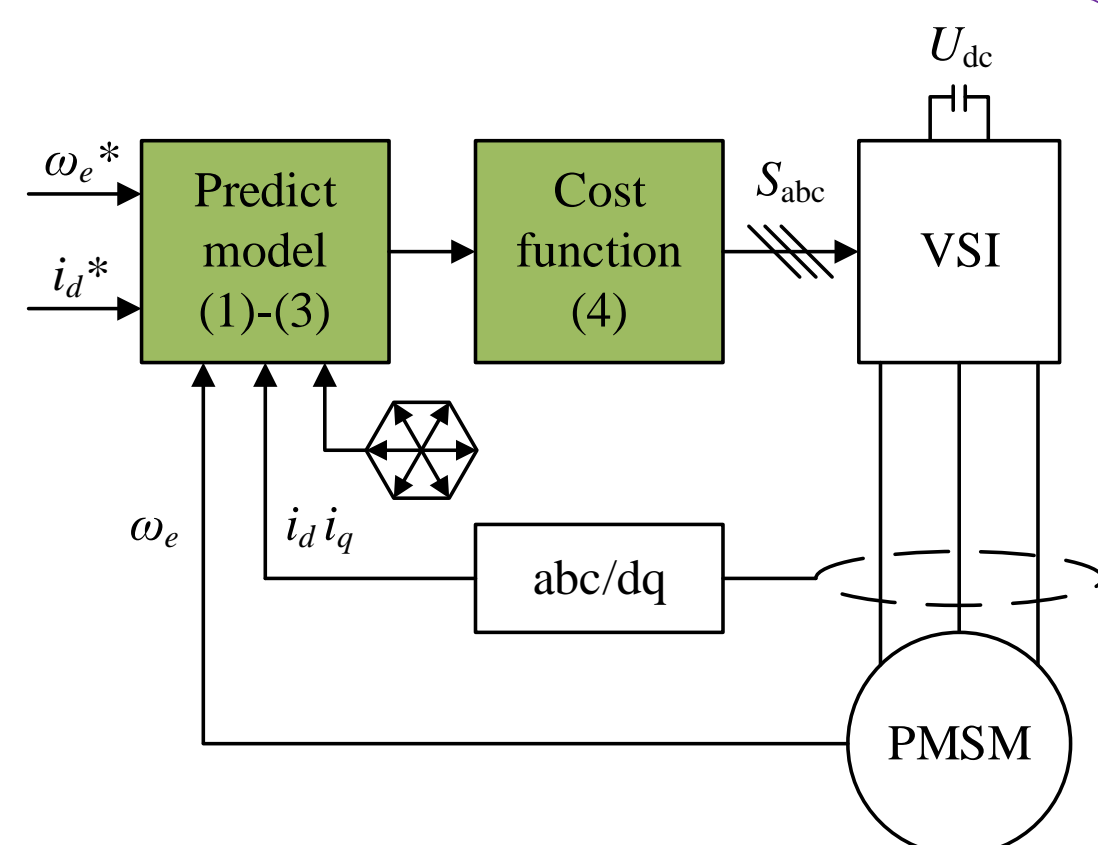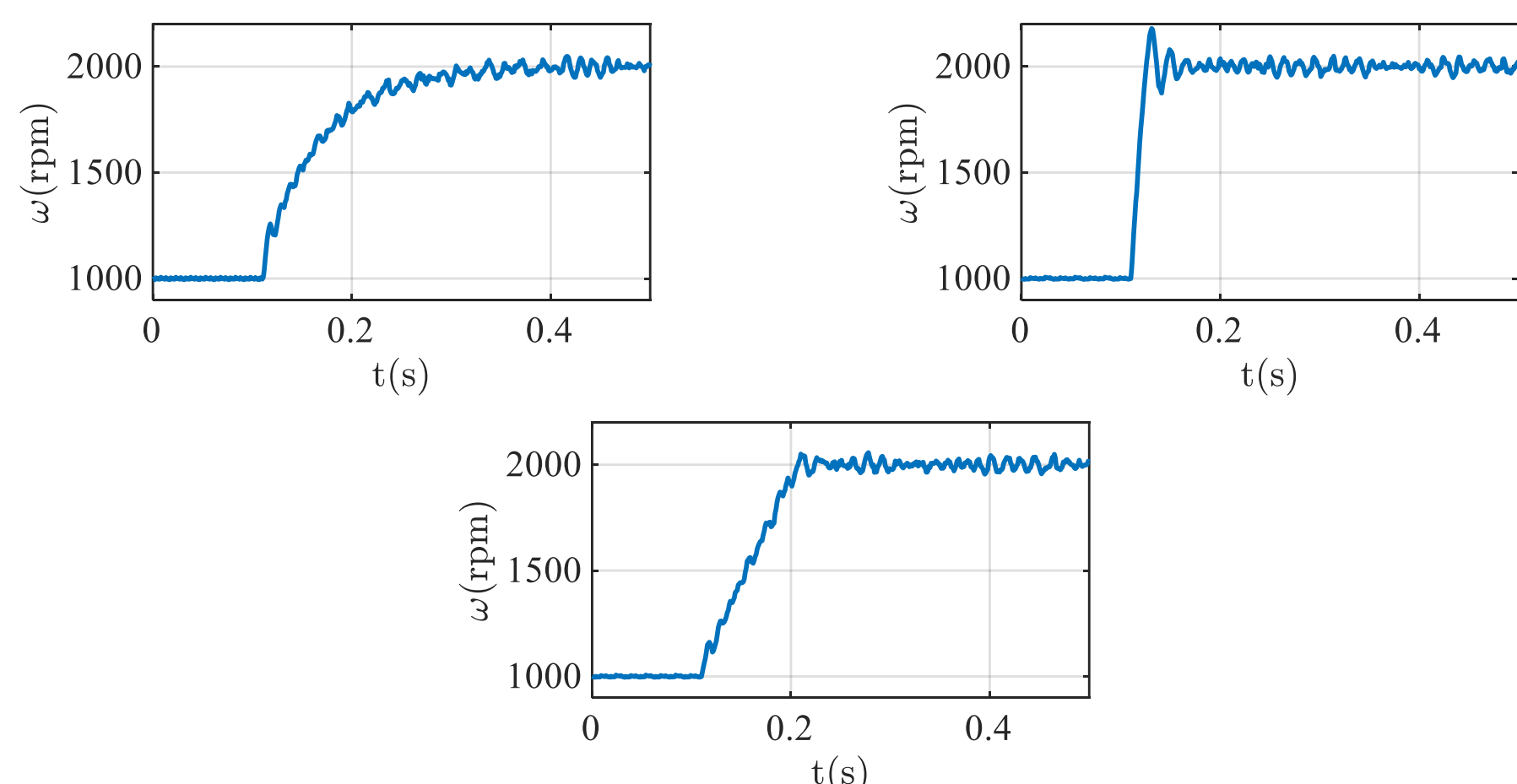


## Parameter Analysis

➤ control performance of PMSM in DSMPC is heavily influenced by the weighting parameters.
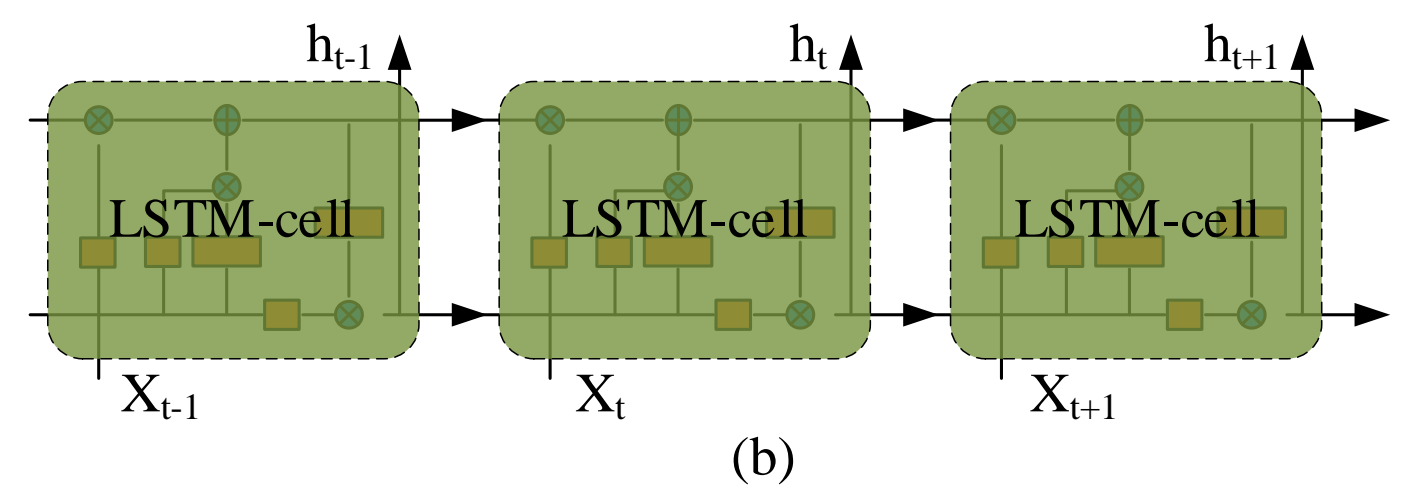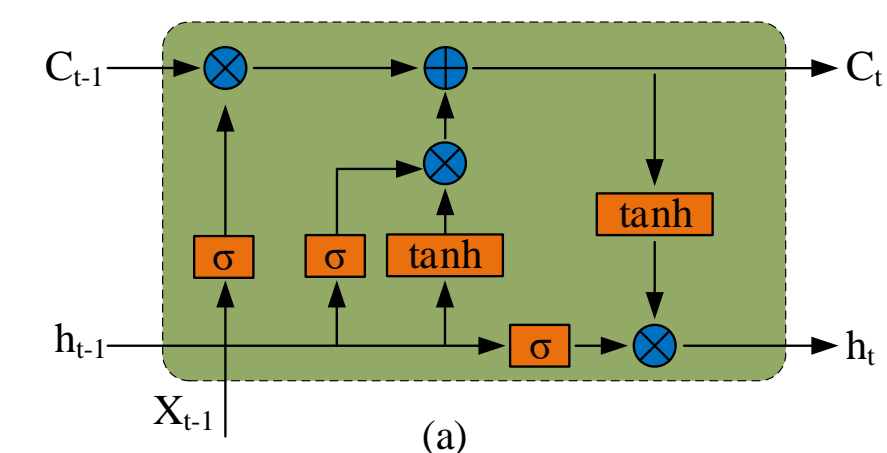


The relative error accumulation of speed and current under one specific condition ($\omega^*$ = 500rpm，TL=0.3N.m).

## Cost function of optimization with driver's perception through LSTM
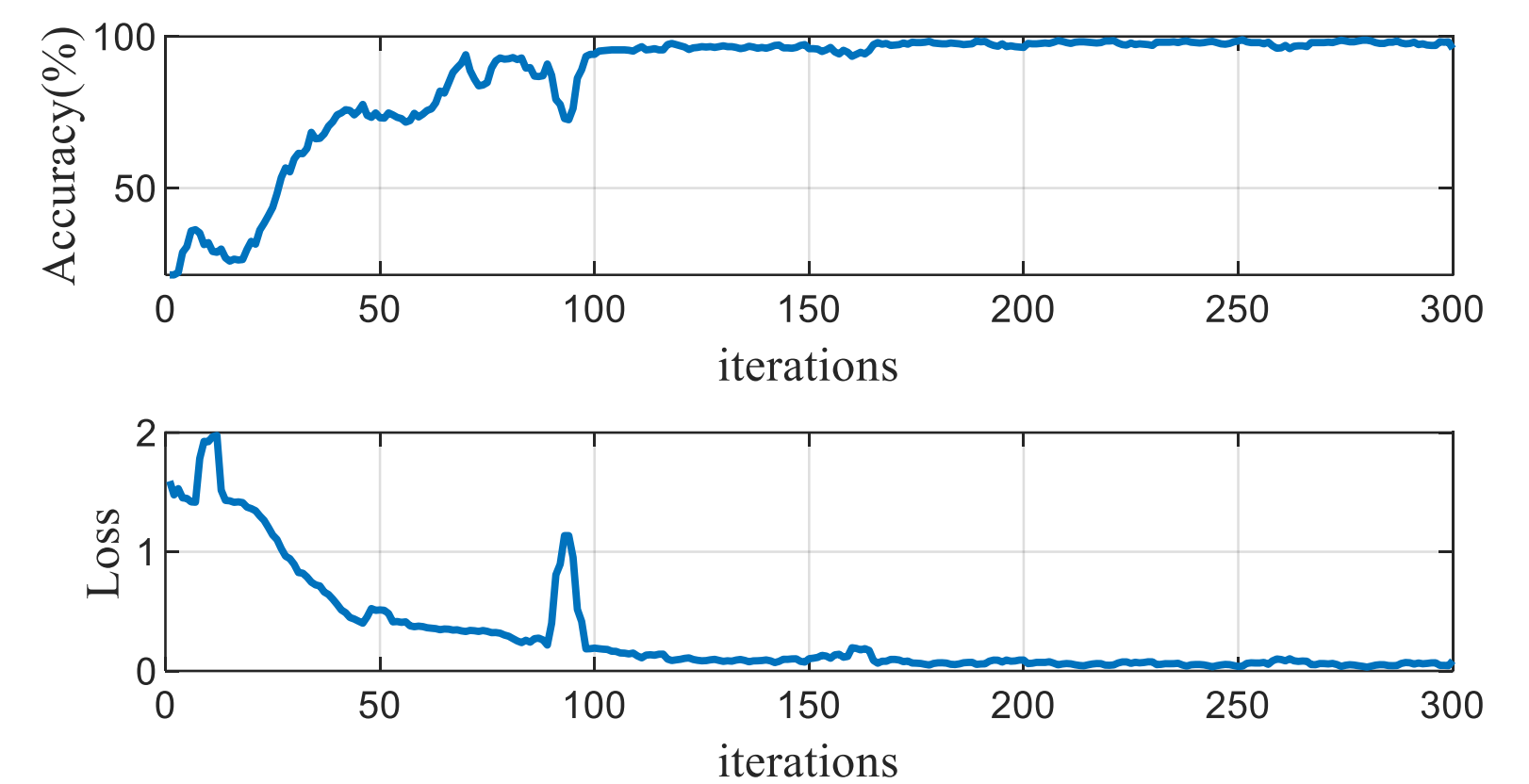


Three typical driver's perception labelled as (a) 'comfortable', (b) 'fast', and (c) 'disgusting'
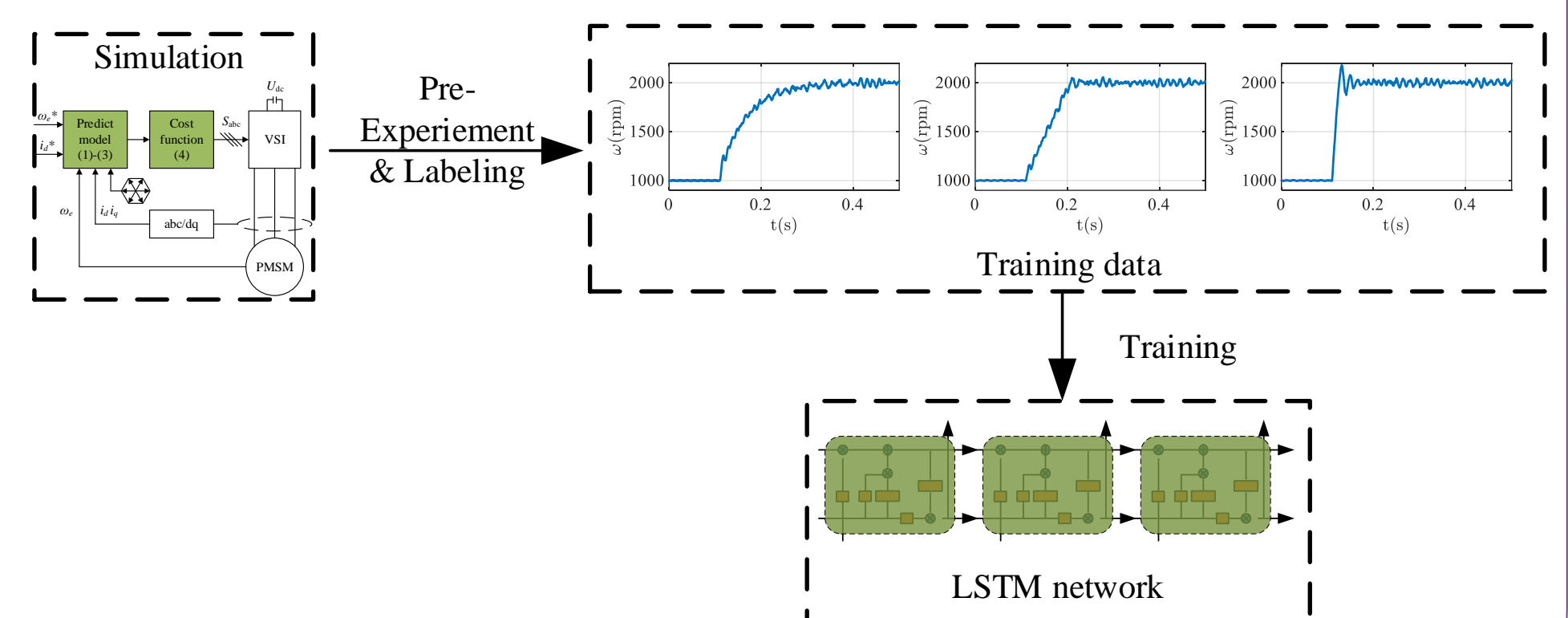
## LSTM Train



(a)



(b)

Typical structure of LSTM (a) LSTM cell, (b) LSTM network.



Training process of LSTM

## Parameters optimization based on PSO



Overview of the proposed algorithm

## Conclusion

Simulation results demonstrate the effectiveness of the approach in accurately capturing driver perception and enhancing the overall driving experience.