

# Introduction

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Welcome to my dissertation on deep learning for time series analysis.

## Chapter 1: Deep Learning Techniques for Time Series Forecasting

### Abstract

This chapter explores...

### Introduction

Deep learning has...

Combining Kolmogorov-Arnold Networks (KANs) with state-space models to improve extrapolation performance is an innovative approach that leverages the strengths of both methodologies. Here are some potential approaches to achieve this integration:

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Sure, here is the revised text with the appropriate replacements:

#### 4. State Augmentation

Augment the state vector with additional features generated by the KAN to capture more complex dynamics.

**Feature Extraction:** Use the KAN to generate additional features from the original state vector and input vector. These features can capture nonlinear relationships that the state-space model might miss:

$$z_t = f_{KAN}(x_t, u_t)$$

**Augmented State-Space Model:** Define an augmented state-space model that includes both the original state vector and the features generated by the KAN:  $\tilde{x}_t = [x_t; z_t]$   
 $\tilde{x}_{t+1} = \tilde{A}\tilde{x}_t + \tilde{B}u_t + \tilde{w}_t$   
 $y_t = \tilde{C}\tilde{x}_t + \tilde{D}u_t + \tilde{v}_t$  Combining KANs with state-space models in these ways can help leverage the strengths of both approaches, potentially leading to better extrapolation performance in dynamic systems.

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