

The University of Oxford
Engineering Science

4YP Project Report

- Using Machine Learning to Control Software Synthesisers -

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Abstract

Software Synthesisers (Soft-Synths) are computer applications which create sounds in response to musical input typically in the form of MIDI messages. They are widely used in a variety of musical contexts. Typical soft-synths have hundreds or thousands of parameters which control the sound generation algorithm, allowing the user to create sounds that suit their musical needs. This results in a high dimensional, non-linear search space which the user must navigate in order. Research indicates that humans are bad at navigating such interfaces with serial controls, and that there is a strong link between interface design and the level of creativity that the user with experience when using the interface.

This work describes a novel interface designed to help users control synthesisers in a quicker and more intuitive manner. It combines 3 interfaces together: a traditional 'knob and slider' interface, a search space visualisation interface, and an iterative blending interface.

THIS ABSTRACT NEEDS A LOT MORE WORK, WILL WORK ON AFTER WRITING MORE OF THE REPORT

Contents

1	Introduction	1
1.1	Background Information	1
1.2	Aims of the project	1
1.3	Methodology	1
2	Literature Review	2
2.1	Previous studies of synthesiser parameter spaces	2
2.2	Previous attempts of using machine learning to control synthesisers	2
2.3	Description of HCI design principles for creative musical interfaces	2
3	Description of Synthesiser and Image Processing Algorithms	3
3.1	Synthesiser Algorithm	3
3.1.1	Description	3
3.1.2	Design choices and justification	3
3.2	Image Processing Algorithm	3
3.2.1	Description	3
3.2.2	Design choices and justification	3
4	Description of Full Interface	4
4.1	Traditional Interface	4
4.2	PCA Interface	4
4.3	Blending Interface	4
4.4	How the interfaces are combined	4
5	Design and Evaluation of Interfaces	5
5.1	Traditional Interface	5

5.1.1	Detailed Description	5
5.1.2	Strengths	5
5.1.3	Weaknesses	5
5.2	PCA interface	5
5.2.1	Detailed Description	5
5.2.2	Global PCA vs Time/Timbre PCA	5
5.2.3	PCA + Histogram Equalisation Description	6
5.2.4	Demonstrations of preset group clustering	6
5.2.5	Investigate how the PCA mapping scales with number of presets	6
5.2.6	Quantify the extra variance the macro controls give	6
5.2.7	Investigate Permutation Ambiguity	6
5.3	Blending Interface	6
5.3.1	Detailed Description	6
5.3.2	Strengths	6
5.3.3	Weaknesses	6
5.3.4	Development / Verification using Image Editing Interface	6
5.3.5	Investigate Permutation Ambiguity	7
5.4	Comparisons of interfaces	7
5.4.1	Perfect /Imperfect User Model	7
5.4.2	Comparison of isolated interfaces	7
5.4.3	Comparison of combined interfaces	7
6	User tests and Interviews	8
7	Conclusion	9
7.1	Further Work	9

Chapter 1

Introduction

1.1 Background Information

Software Synthesisers (Soft-Synths) are computer applications which create sounds in response to musical input typically in the form of MIDI messages. They are widely used in a variety of musical contexts. Typical soft-synths have hundreds or thousands of parameters which control the sound generation algorithm, allowing the user to create sounds that suit their musical needs. This results in a high dimensional, non-linear search space which the user must navigate in order. Research indicates that humans are bad at navigating such interfaces with serial controls, and that there is a strong link between interface design and the level of creativity that the user with experience when using the interface.

This work describes a novel interface designed to help users control synthesisers in a quicker and more intuitive manner. It combines 3 interfaces together: a traditional 'knob and slider' interface, a search space visualisation interface, and an iterative blending interface.

1.2 Aims of the project

Aim to ...

1.3 Methodology

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Chapter 2

Literature Review

2.1 Previous studies of synthesiser parameter spaces

Several previous...

2.2 Previous attempts of using machine learning to control synthesisers

There have been several previous attempts...

2.3 Description of HCI design principles for creative musical interfaces

A number of guidelines for creative musical interfaces

Chapter 3

Description of Synthesiser and Image Processing Algorithms

3.1 Synthesiser Algorithm

3.1.1 Description

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3.1.2 Design choices and justification

asdasdasdsa

3.2 Image Processing Algorithm

3.2.1 Description

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3.2.2 Design choices and justification

asdasdas

Chapter 4

Description of Full Interface

4.1 Traditional Interface

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4.2 PCA Interface

asdasdasdsa

4.3 Blending Interface

asdasdasdsa

4.4 How the interfaces are combined

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Chapter 5

Design and Evaluation of Interfaces

5.1 Traditional Interface

5.1.1 Detailed Description

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5.1.2 Strengths

asdasdad

5.1.3 Weaknesses

asdasdsa

5.2 PCA interface

5.2.1 Detailed Description

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5.2.2 Global PCA vs Time/Timbre PCA

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5.2.3 PCA + Histogram Equalisation Description

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5.2.4 Demonstrations of preset group clustering

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5.2.5 Investigate how the PCA mapping scales with number of presets

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5.2.6 Quantify the extra variance the macro controls give

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5.2.7 Investigate Permutation Ambiguity

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5.3 Blending Interface

5.3.1 Detailed Description

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5.3.2 Strengths

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5.3.3 Weaknesses

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5.3.4 Development / Verification using Image Editing Interface

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Tests of Image Comparison Metric

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Convergence Tests for different preset generation algorithms

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5.3.5 Investigate Permutation Ambiguity

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5.4 Comparisons of interfaces

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5.4.1 Perfect /Imperfect User Model

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5.4.2 Comparison of isolated interfaces

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5.4.3 Comparison of combined interfaces

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Chapter 6

User tests and Interviews

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Chapter 7

Conclusion

The interface proposed in this project has many benefits over a traditional synthesiser interface, as has been designed following design heuristics from the fields of Human Computer Interaction and Creative Cognition. Based on simulated user studies, the interface has at least as good performance as a traditional interface when carrying out search based tasks, and based on real user feedback it has many advantages in terms of creativity.

7.1 Further Work

The evaluation of this interface was only carried out on a single synthesiser, due to the projects time constraints. The interface has been designed to be as general purpose as possible, allowing it to control arbitrary synths over the OSC protocol, but due to a lack of standardisation between soft synths, and lack of implementation time, more work needs to be done to create a truly general purpose soft synth controller. As many soft-synths are in the VST format, making a version of the interface which acts as a VST host, and uses the parameter retrieval and preset storage functionality of VSTs is a good next goal if this project is continued in the future.

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