A Web-Based Platform to Teach Music Online

AUBURN UNIVERSITY | SAMUEL GINN COLLEGE OF ENGINEERING

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Resume of the Presenter

- Fatemeh Jamshidi is a Ph.D. student under Dr. Richard Chapman and Dr. Marghitu in Computer Science and Software Engineering at Auburn University. Her research is focused on machine learning techniques in music. She has been the coordinator of CS4AllG and MAGIC camps for more than two year where she designed the curriculums for middle school and high school students to learn computer science through music in much more engaging, entertaining, and fun way.

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Outline

- Related Work
- Research Motivations
- Curriculum Design
- Pitch Detection

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Presentation Video Link:

- YouTube Link of Presentation:

https://www.youtube.com/watch?v=8TQ9F7gjpDM

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Main Goal

This research concerns online music education and as contribution, it proposes a new technological framework to support online music performance teaching.

To reduce loads on teachers for assessing large number of student performances.

To make the existing applications more interactive.

In order to improve the efficiency of traditional music teaching, with the multi-sensing, immersion and interactivity feature in the virtual reality (VR) technology, this project aims to solve the low cross mutual inductance and low efficiency in traditional music teaching.

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Related Work

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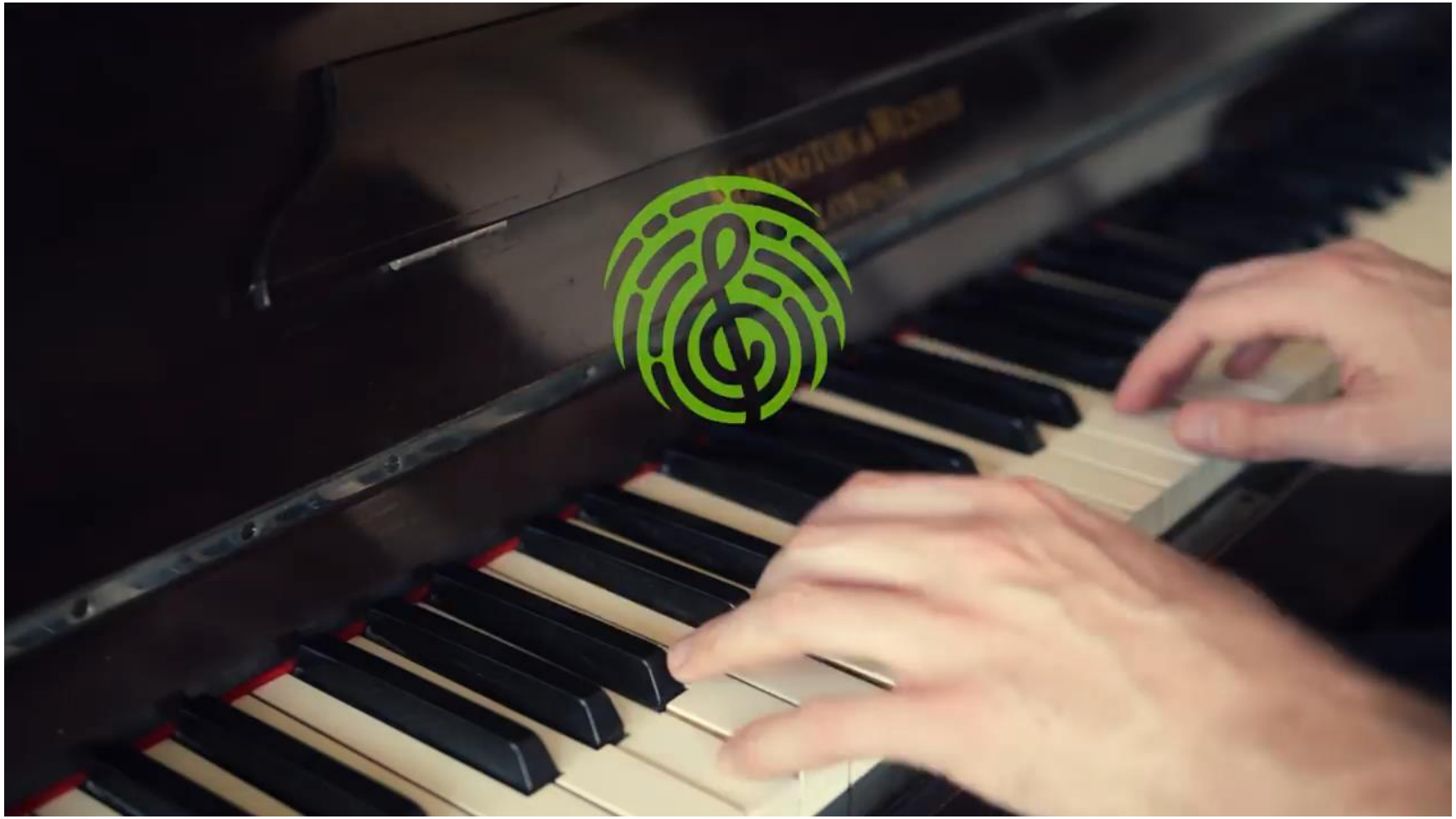
Related Work



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Research Motivation

Recent investigations show that online resources used together with face-to-face delivery in a blended learning model leads to significant increase in motivation and progress for music students.

In this research, we specifically focus on such technical difficulties concerning online music courses with very large sized audiences (the MOOCs)

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Application Components

- Teaching Music Theory
- Teaching How to Practice (Dr. Nancy Barry's Research)
- Music Performance Assessment (Online Error Identification Algorithm)
- Making a team , Auto generated team (Artificial Intelligence, Machine Learning)
  1. Individual selection
- Music Ensemble note decomposition (Keyboard. Master)
  - Detecting single instrument (Along with note generator)
  - Recording individual players
  - Recording group performance
- Pitch Detection
- Beat Tracking

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Plan of the Research

- First, we consider the interfaces for practice exercises, recording student performances, assessing the performances and providing feedback to the students.

- Second, tools for facilitating assessment will be considered where we demonstrate a semi-automatic assessment system that can learn from assessment of the instructor on a small group of performances and further assess larger sets of performances using Machine Learning Algorithms.

- We finally present tests performed on real-life data to demonstrate the potential of the approach.

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Online courses for learning music

- There are three types of online courses for learning music performance
  - video tutorials,
  - real-time video calls with the teachers, and
  - Massive Online Music Courses (MOOCs).

- Melodics
- https://nitish6174.github.io/pianofy/

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Phase One: Curriculum and Teaching Strategies

- Curriculum http://www.myaccessiblemath.com/csmusic/PreStudentDashboardServlet?grade=1

Unit 1: Music Beats and Rhythm
In this unit, students will learn about the basic music concepts such as music beats and music rhythm.

Unit 2: Music Rhythm Patterns and Making Beats.
In this unit, students will learn about the basic music concepts such as music beats and music rhythm.

Unit 3: Music Melody
In this Unit, students will learn about music melody and start making melodic and rhythmic pieces for their dancing robot.

Unit 4: Music Dynamics
Unit 4 focuses on coding large-scale changes in music efficiently, which will help you create longer compositions with EarSketch. Students will also learn about setEffect() function in EarSketch and how to add

Unit 5: Music harmony and forms
Students will learn the basics of music harmony and forms in EarSketch. As their final project, students should complete their music compositions for their dancing robot. The final project should demonstrate

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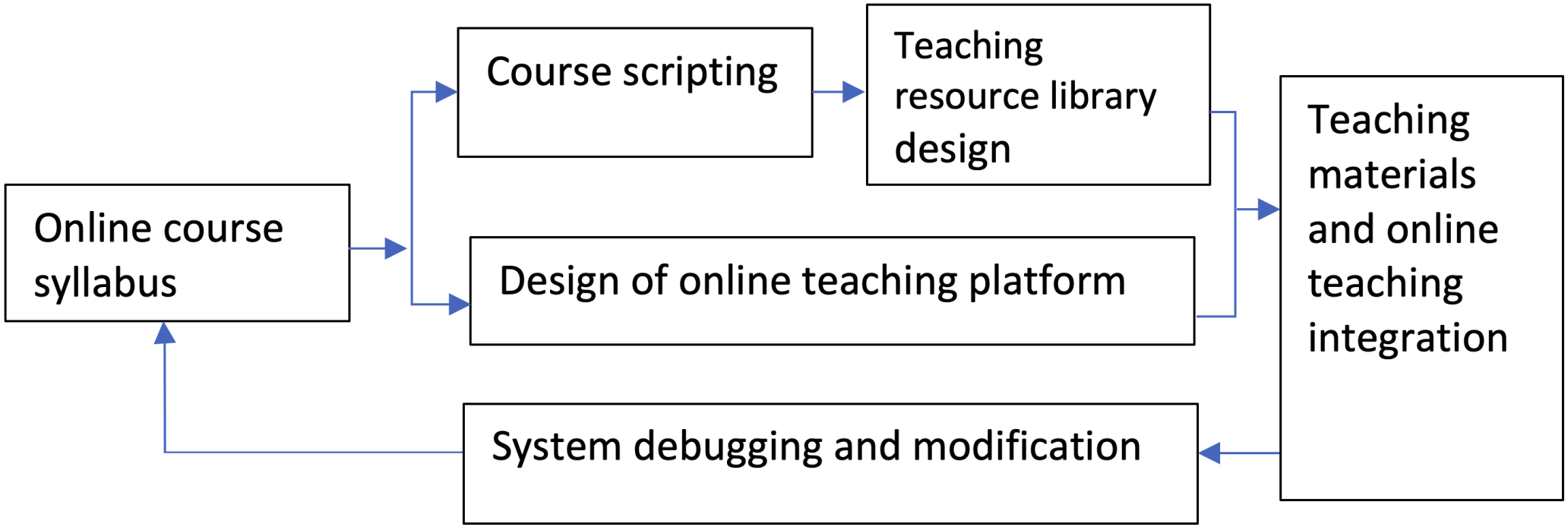
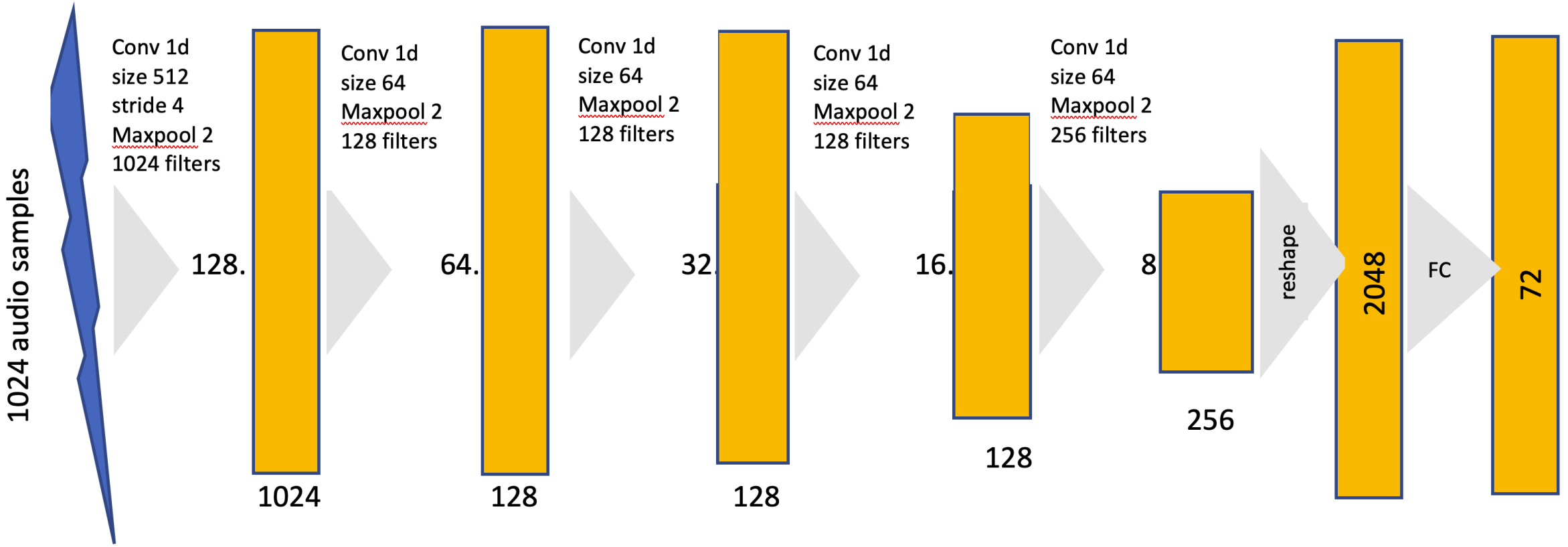
Development of the curriculum:



CNN for Pitch Detection



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Pitch Detection

$$\psi(f) = 1200 \times log_2 \frac{f}{f_{ref}} \tag{1}$$

$$\hat{\psi} = \frac{\sum_{i=1}^{72} \hat{y}\psi_i}{\sum_{i=1}^{72} \hat{y}}, \hat{f} = f_{ref}.2^{\frac{\hat{\psi}}{1200}} \tag{2}$$

$$y_i = \exp(-\frac{(\psi_i - \psi_{true})^2}{2.25^2}) \tag{3}$$

$$\Gamma(y, \hat{y}) = \sum_{i=1}^{72}(-y_i.log\hat{y}_i - (1 - y_i)log(1 - y_i)) \tag{4}$$

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Future Work

- Make the website accessible for students with disability
- Finalize the artificially intelligent machine learning model which trains itself to respond to students based on their own skills, attitude, and expertise.

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