Lab 1 - Crossfade Product Description

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CrossFade

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Lab 1 - Crossfade Product Description

1 Introduction

- The barrier of entry to the music industry is very high for starting musicians.
- There is a need for technical equipment for producing MIDI files which most people do not have.
- Aspiring musicians might not be familiar with sheet music, so there is no way for them to share their music in a written format.
- Without soundboards or keyboards that can output MIDI, it can feel difficult to produce or share music.
- It can be overwhelming to enter the music field due to the amount of information and tools needed to succeed.
- Burnout is especially common at the beginning of learning or working on music.
- CrossFade's aim is to resolve those problems.

2 Product Description

- Lower the barrier of entry for starting musicians.
- Allow new creators to share their music by writing it down.

2.1. Key Product Features and Capabilities

- Automatic transcription of the music input.
- Automatic correction of music input.
- Ability to edit the transcription.
- Recognition of different instruments.

2.2. Major Components (Hardware/Software)

Hardware:

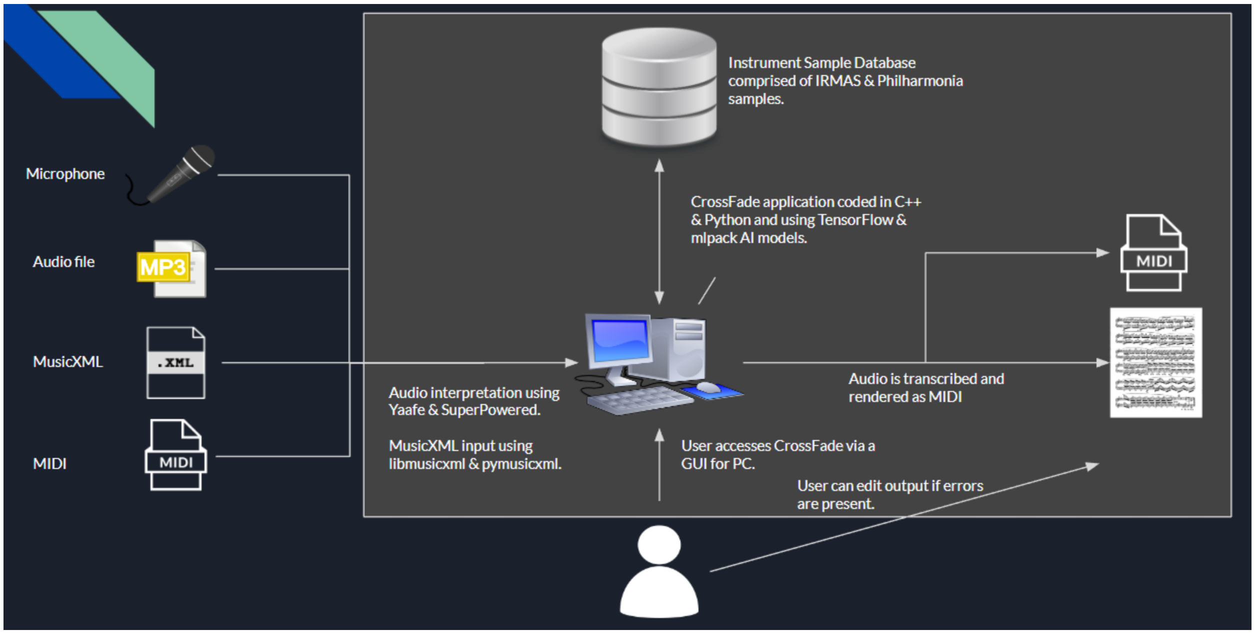
- Computer.
- Musical instruments.
- Microphone.

Software:

- Audio parsing and interpreting libraries.
- Database instrument samples.
- MusicXML support.
    - libmusicxml
    - pymusicxml
    - music21
- State-of-the-Art Artificial Intelligence.
- Program written with Python, using C++ for heavier music algorithms.

  Algorithms to be developed:

    - Audio file and live audio transcription.
    - MIDI file transcription.
    - Automatic transcription correction.
    - Manual transcription correction.
    - Musical instrument recognition.



3 Identification of Case Study

- Starting musicians.
- Music creators.

4 Product Prototype Description

- Centered on the transcription correction.

Transcription

Feature	Real World Product	Prototype
Live Audio Transcription	✓	
MIDI Input/File Transcription	✓	
MIDI Transcription Correction	✓	✓
Multitrack Transcription	✓	
MusicXML Compatibility	✓	✓
MIDI File Export	✓	✓

Note Recognition

Feature	Real World Product	Prototype
Monophonic Note Recognition	✓	
Polyphonic Note Recognition	✓	
Instrument Recognition	✓	
Instrument Distinction	✓	

Transcription Error Correction

Feature	Real World Product	Prototype
Transcription Error Correction	✓	✓
Highlight Possible Errors	✓	✓
Take User Feedback	✓	✓
Offer Possible Solutions	✓	✓
Compare Single Note from Original to Written	✓	✓
Compare a Segment from Original to Written	✓	✓

4.1. Prototype Architecture (Hardware/Software)

- Accept MIDI and XML files.
- Automatic error detection, with errors found being highlighted.
- Offer other solutions for each error.
- Ability to play what is written.

4.2. Prototype Features and Capabilities

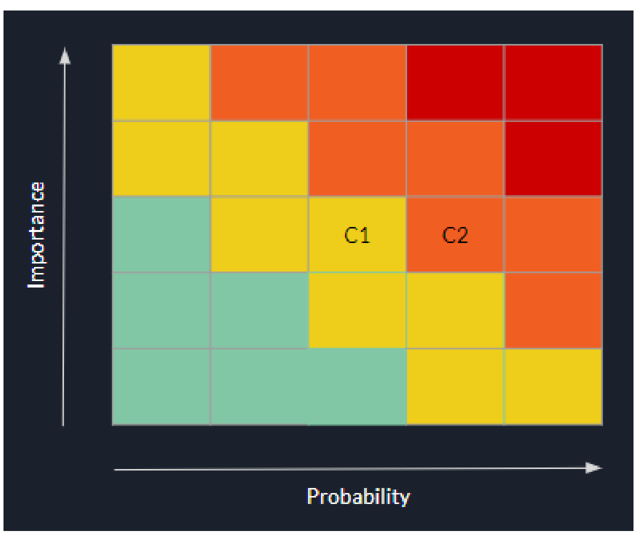
Transcription Features:

- MIDI transcription correction.
- MusicXML compatibility.
- MIDI file export.

Transcription Error Correction Features:

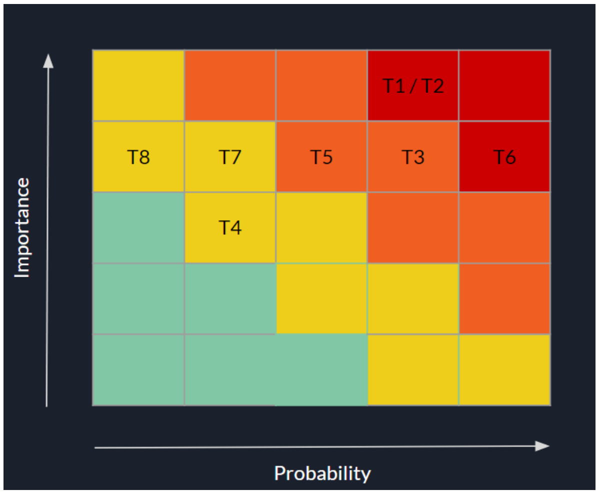
- Transcription error correction.
- Highlight possible errors.
- Take user feedback.
- Offer possible solutions.
- Compare single note/ segment from original to written.

4.3. Prototype Development Challenges



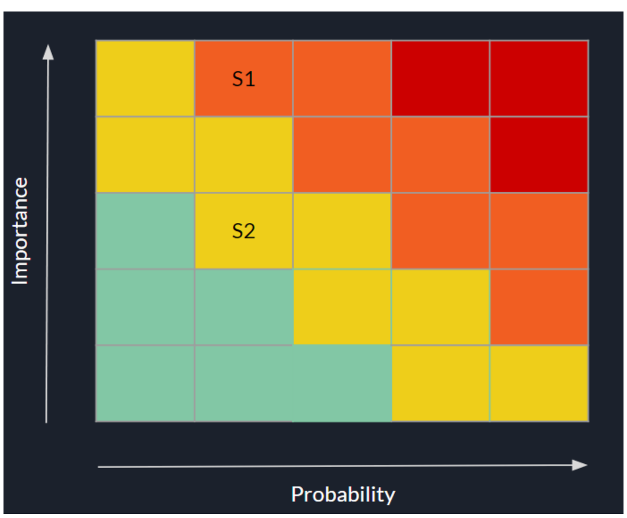
Customer Risks:

- C-1 Difficulty using the application.
- C-2 Unfamiliarity with the terms.



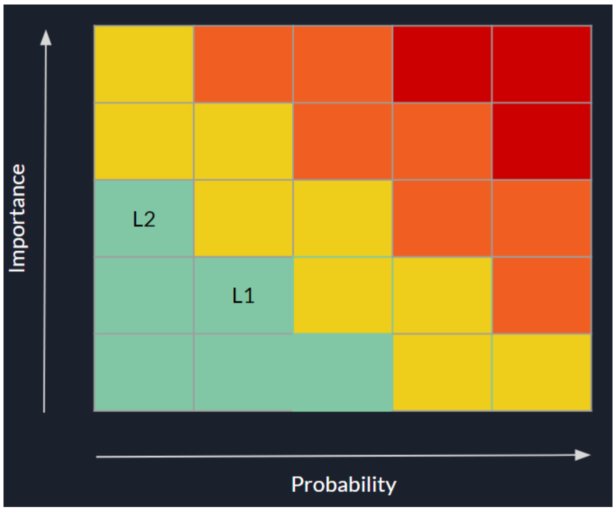
Technical Risks:

- T-1 Multi-pitch detection Feature Difficulty.
- T-2 Note Tracking Feature Difficulty.
- T-3 Overestimating system performance.
- T-4 Limited system performance due to musical diversity.
- T-5 Library Availability.
- T-6 User Inputted Recognizability.
- T-7 Applying incorrect correction rules when correcting music notation.
- T-8 Bias in the correction process.



Security Risks:

- S-1 Intellectual property.
- S-2 Application vulnerability.



Legal Risks:

- L-1 Unlawful product use.
- L-2 Copyright Law.

5 Glossary

Convolutional Neural Network (CNN) - Deep learning algorithm which can differentiate one image from another by assigning weights and biases to different aspects of the images. It is used in audio to differentiate different frequencies in a visual format.

Deep Learning - Subfield of machine learning which uses neural networks to solve complex problems. Learning comes directly from the data, instead of being hand-engineered by humans.

Keyboard - An electronic piano used to produce sound and MIDI information.

Monophony - A phrase of music in which only a single voice is played at a time.

Musical Instrument Digital Interface (MIDI) - A communications protocol used to connect physical and virtual music devices and instruments. MIDI files store note information which can be used to trigger instruments and devices.

MusicXML - A markup language format used to interchange and distribute digital sheet music.

Polyphony - A phrase of music in which more than a single voice is played at a time.

6 References

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