PROJECT CANTILENA
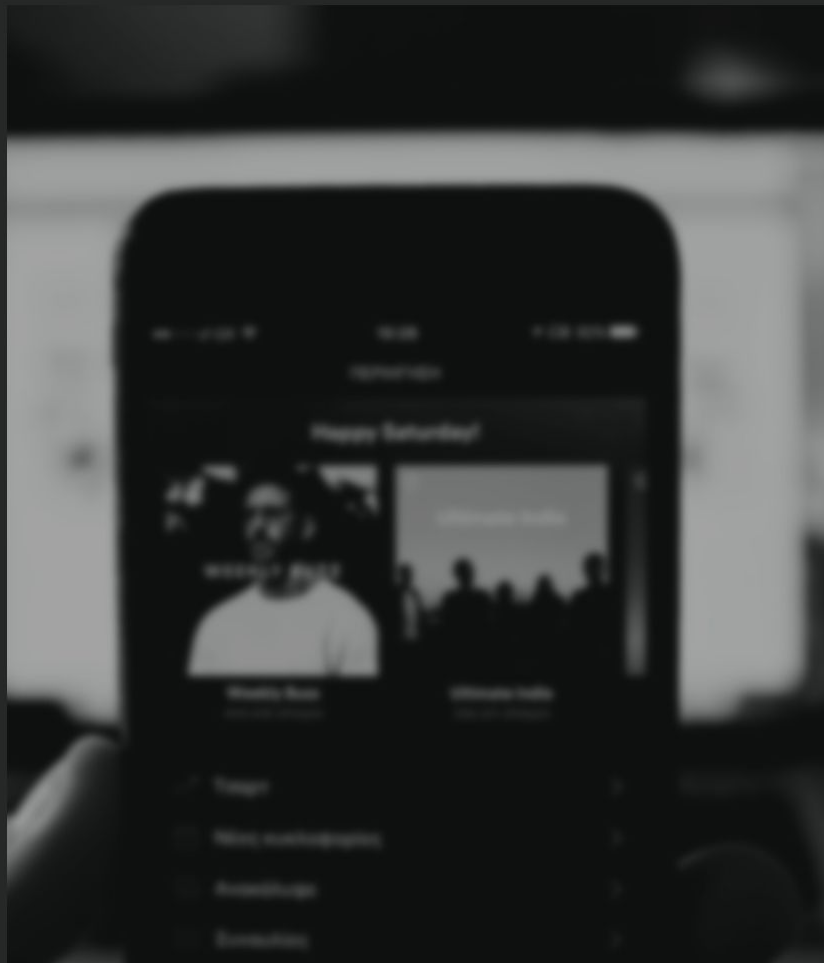
TEAM HARMONY
KARAMJIT SINGH BEDI
TISHA TISHA
HARDIK SARRAF
ANGAD BAGGA

The Problem

There are hundreds of applications that help musicians compose music. World-renowned artists like Rihanna have used applications like Garage Band. However, there has been little to no research on Music suggestions for professional composers.

The Solution

Enter Project Cantilena, which leverages its capabilities to provide personalised musical suggestions

OPTICAL MUSIC RECOGNITION

Cantilena identifies the notes and terminologies given in the Musical Score

GENRE RECOGNITION

Cantlena uses its unique, one-of-a-kind method to identify the Genre and play-style of the song being composed

LITERAL AUTO-TUNE

By identifying the sequence of notes and recognising the style of the musician, Cantilena suggests the ideal notes for your Masterpiece

MUSIC THAT SPEAKS TO YOU

Cantilena recognises the sequences of your notes while forming a musical context

MUSIC THAT MATCHES THE VIBE

Cantilena identifies the underlying vibe in your beats

MUSIC THAT FEELS PERSONAL

Using the power of Neural Networks, Cantilena provides musical suggestions catered to the user's style, the tempo of the composition and the genre of the song

STATE-OF-THE-ART MUSICAL INTELLIGENCE

OUR PROPOSED MOBILE APPLICATION INTERFACE

Team Harmony aims to build a user-friendly graphical interface for Project Cantilena that appeals to musicians worldwide
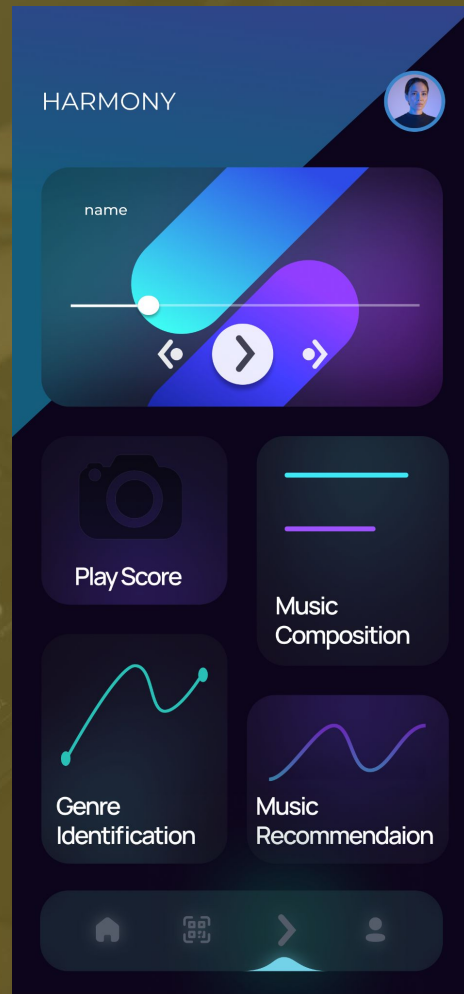
Cantilena
The Real Auto-Tune

"Without music, life would be a mistake."

FRIEDRICH NIETZSCHE

OPTICAL MUSIC RECOGNITION (OMR)

Team Harmony

OPTICAL MUSIC RECOGNITION IS A FIELD OF RESEARCH THAT INVESTIGATES HOW TO COMPUTATIONALLY READ MUSIC NOTATION IN DOCUMENTS.

THE GOAL OF OMR IS TO TEACH THE COMPUTER TO READ AND INTERPRET SHEET MUSIC AND PRODUCE A MACHINE-READABLE VERSION OF THE WRITTEN MUSIC SCORE. ONCE CAPTURED DIGITALLY, THE MUSIC CAN BE SAVED IN COMMONLY USED FILE FORMATS, E.G. MIDI (FOR PLAYBACK) AND MUSICXML (FOR PAGE LAYOUT).

acoustic

spianato

irato

OMR

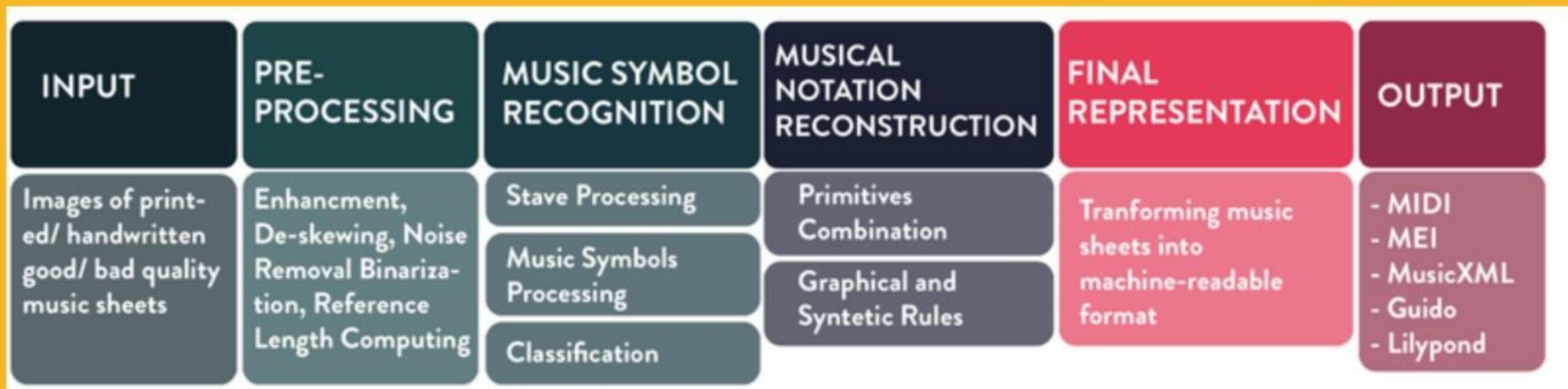## OPTICAL MUSIC RECOGNITON

OCR

OPTICAL CHARACTER RECOGNITON

- OPTICAL MUSIC RECOGNITION HAS FREQUENTLY BEEN COMPARED TO OPTICAL CHARACTER RECOGNITION. THE BIGGEST DIFFERENCE IS THAT MUSIC NOTATION IS A FEATURAL WRITING SYSTEM. THIS MEANS THAT WHILE THE ALPHABET CONSISTS OF WELL-DEFINED PRIMITIVES (E.G., STEMS, NOTEHEADS, OR FLAGS), IT IS THEIR CONFIGURATION – HOW THEY ARE PLACED AND ARRANGED ON THE STAFF – THAT DETERMINES THE SEMANTICS AND HOW IT SHOULD BE INTERPRETED

- THE SECOND MAJOR DISTINCTION IS THE FACT THAT WHILE AN OCR SYSTEM DOES NOT GO BEYOND RECOGNIZING LETTERS AND WORDS, AN OMR SYSTEM IS EXPECTED TO ALSO RECOVER THE SEMANTICS OF MUSIC: THE USER EXPECTS THAT THE VERTICAL POSITION OF A NOTE (GRAPHICAL CONCEPT) IS BEING TRANSLATED INTO THE PITCH (MUSICAL CONCEPT) BY APPLYING THE RULES OF MUSIC NOTATION.

- THE THIRD DIFFERENCE COMES FROM THE USED CHARACTER SET. ALTHOUGH WRITING SYSTEMS LIKE CHINESE HAVE EXTRAORDINARILY COMPLEX CHARACTER SETS, THE CHARACTER SET OF PRIMITIVES FOR OMR SPANS A MUCH GREATER RANGE OF SIZES, RANGING FROM TINY ELEMENTS SUCH AS A DOT TO BIG ELEMENTS THAT POTENTIALLY SPAN AN ENTIRE PAGE SUCH AS A BRACE. SOME SYMBOLS HAVE A NEARLY UNRESTRICTED APPEARANCE LIKE SLURS, THAT ARE ONLY DEFINED AS MORE-OR-LESS SMOOTH CURVES THAT MAY BE INTERRUPTED ANYWHERE.

- FINALLY, MUSIC NOTATION INVOLVES UBIQUITOUS TWO-DIMENSIONAL SPATIAL RELATIONSHIPS, WHEREAS TEXT CAN BE READ AS A ONE-DIMENSIONAL STREAM OF INFORMATION, ONCE THE BASELINE IS ESTABLISHED.

MANY COMPETING APPROACHES HAVE BEEN PROPOSED WITH MOST OF THEM SHARING A PIPELINE ARCHITECTURE

| INPUT	PRE-PROCESSING	MUSIC SYMBOL RECOGNITION	MUSICAL NOTATION RECONSTRUCTION	FINAL REPRESENTATION	OUTPUT
Images of printed/ handwritten good/ bad quality music sheets	Enhancment, De-skewing, Noise Removal Binarization, Reference Length Computing	Stave Processing Music Symbols Processing Classification	Primitives Combination Graphical and Syntetic Rules	Tranforming music sheets into machine-readable format	- MIDI - MEI - MusicXML - Guido - Lilypond

- THE USUAL INPUTS TO THIS PIPELINE ARE SCANS/PICTURES OF PRINTED/HANDWRITTEN MUSIC SHEETS. THESE IMAGES ARE THEN SUBJECT TO IMAGE PROCESSING TECHNIQUES. THESE TECHNIQUES INCLUDE BINARIZATION (BLACK AND WHITE), BLURRING, DE-SKEWING (ROTATION), AND WILL HELP IN REDUCING THE NOISE IN THE IMAGE.

- ENHANCED IMAGES WILL NEXT BE USED IN MUSIC OBJECT RECOGNITION. IN THIS STEP, THE ALGORITHM WILL TRY TO IDENTIFY MUSICAL OBJECTS SUCH AS CLEFS, NOTEHEADS, BARS, SLURS, AND OTHERS. IN THIS STAGE, THE OBJECTS ARE PRIMITIVES AND SEPARATE FROM THEIR SEMANTIC MEANING.

- CONSEQUENTLY, THE NEXT STEP ATTEMPTS TO RECONSTRUCT THE RELATIONSHIPS THESE PRIMITIVES HAVE HAD, TOGETHER WITH THE SEMANTIC MEANING. THIS APPROACH REBUILDS THE SEMANTICS BASED ON GRAMMAR RULES THAT EXIST IN MUSIC.
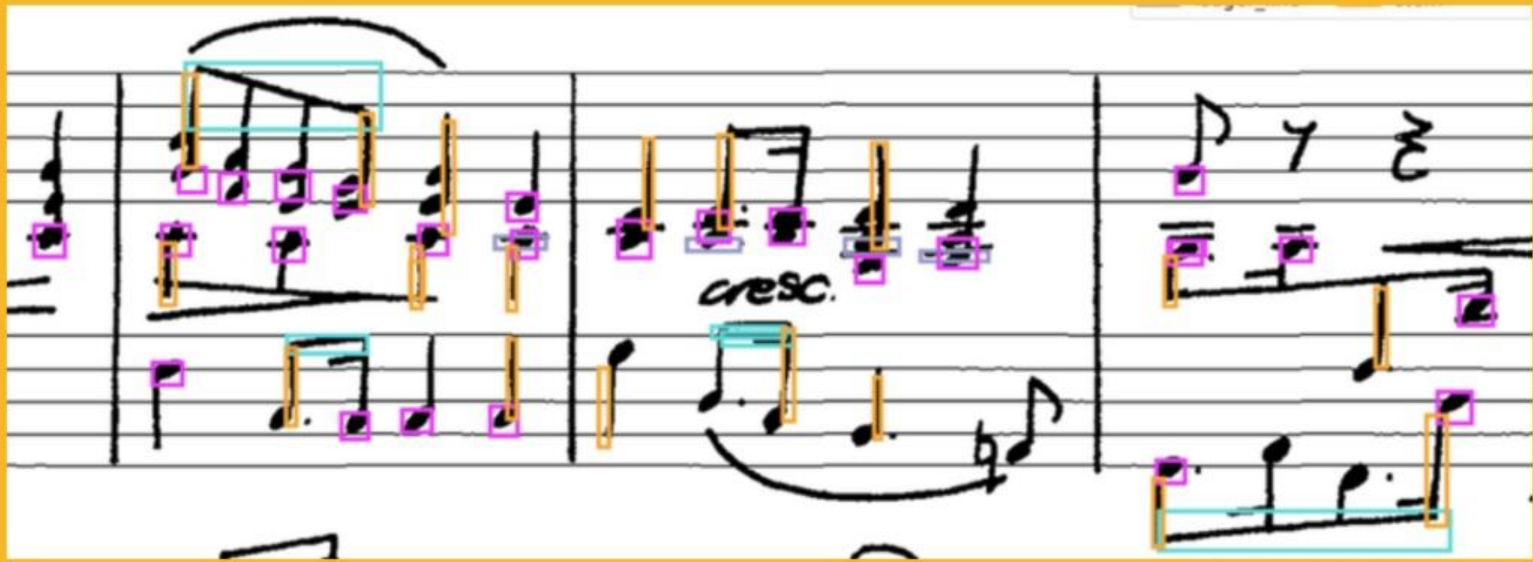
THE FINAL OUTPUT CAN REPRESENT THE MUSICAL MEANING AND DESCRIPTION OF THE MUSIC SCORE IN THE INPUT AND IT IS MACHINE-READABLE. THE USUAL FORMATS OF THESE FILES CAN BE MIDI, MUSICXML, MEI AND SO ON.

CVC MUSCIMA DATABASE

THE MUSCIMA DATABASE CONTAINS IMAGES OF HANDWRITTEN MUSIC SCORES FOR OPTICAL MUSIC RECOGNITION. THE DATABASE HAS BEEN SPECIALLY DESIGNED FOR STAFF REMOVAL AND WRITER IDENTIFICATION
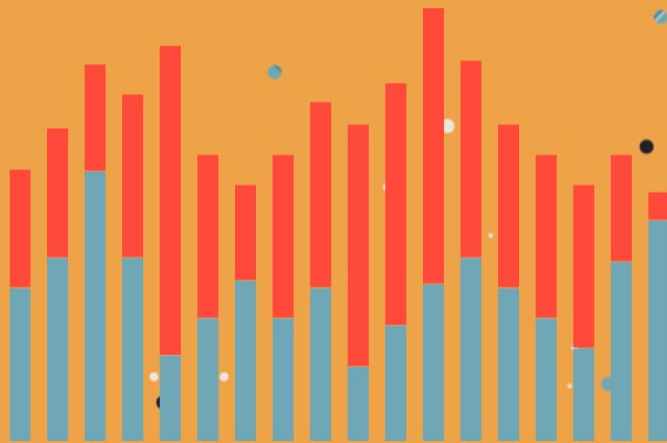
CVC MUSCIMA

THE DATABASE CONTAINS OVER 1000 MUSICAL SHEETS WRITTEN BY OVER 50 DIFFERENT ARTISTS

EACH PAGE HAS BEEN DISTORTED FOR STAFF-REMOVAL, WHICH YIELDS A DATABASE OF OVER 12000 IMAGES

MUSIC GENRE RECOGNITION

1. AUDIO SIGNALS ARE A VERY IMPORTANT PART OF OUR TECHNOLOGICAL ECOSYSTEM

2. MUSICAL COMPOSITIONS ARE CATEGORISED INTO SEPARATE GENRES, WHICH CAN BE AUTOMATED

3. HOWEVER, THIS IS A TEDIOUS PROCESS AND DOES NOT ESSENTIALLY REQUIRE MACHINE LEARNING

TEAM HARMONY

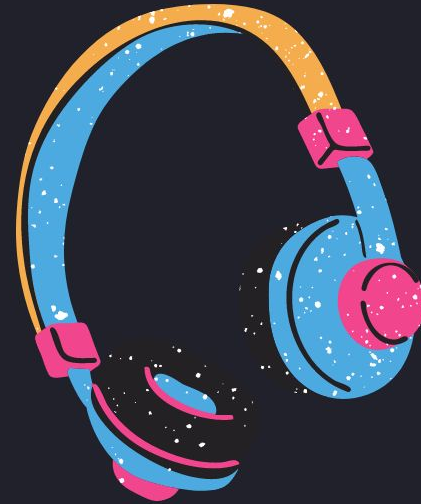# FREE MUSIC ARCHIVE

MUSICAL INTELLIGENCE

BENEATH THE BASS

FMA IS AN EASILY
ACCESSIBLE, METADATA
RICH AND FREELY
AVAILABLE DATABASE
FILLED WITH THOUSANDS
OF AUDIO FILES, SUITABLE
FOR EVALUATING SEVERAL
TASKS LIKE BROWSING,
SEARCHING AND
ORGANISING LARGE
COLLECTIONS OF MUSIC

THE DREAM

PROJECT CANTILENA IS THE BRAINCHILD OF TEAM HARMONY, A CROUP OF FRIENDS WHO CAME TOGETHER TO CREATE A DIFFERENCE IN THE WORLD OF MODERN MUSIC TECHNOLOGY

" Music is the movement of sound to reach the soul for the education of its virtue.

PLATO

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