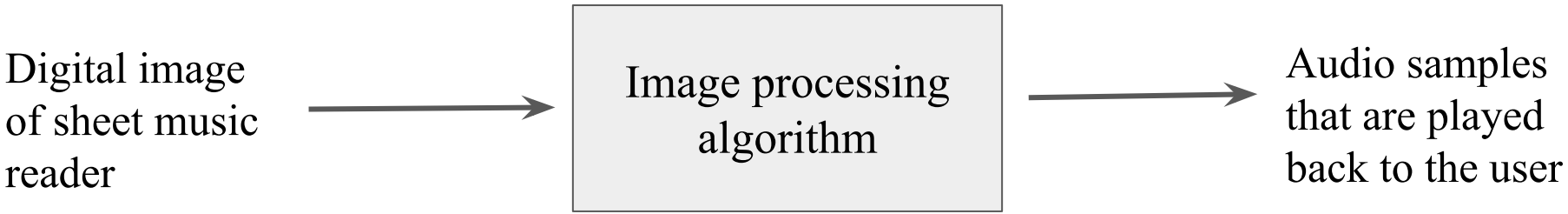
# DIP PROJECT

Sheet Music Reader

# Aim of the project

- To design an image processing algorithm that scans in sheet music and plays the music described on the page.
- The algorithm aims to convert an image to note frequencies that can easily be transposed to other keys and octaves.

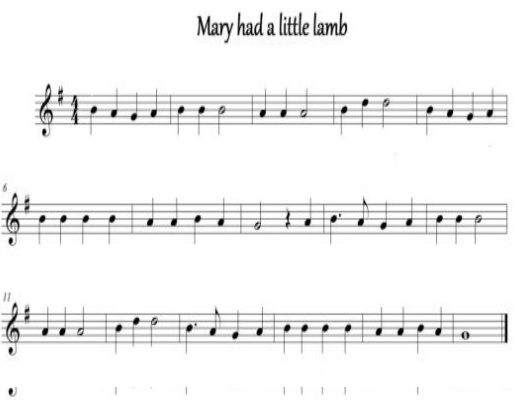


# Methodology :

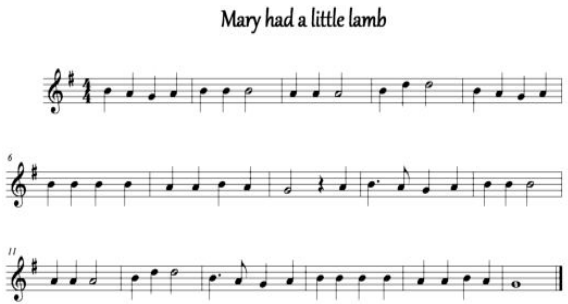
The image processing algorithm used for this purpose works in three steps:

- Segmentation and preprocessing (Enhances the quality of the image)
- Object detection (Detects object of interest)
- Music synthesis (The detected notes are combined and analyzed to produce frequency duration pairs)

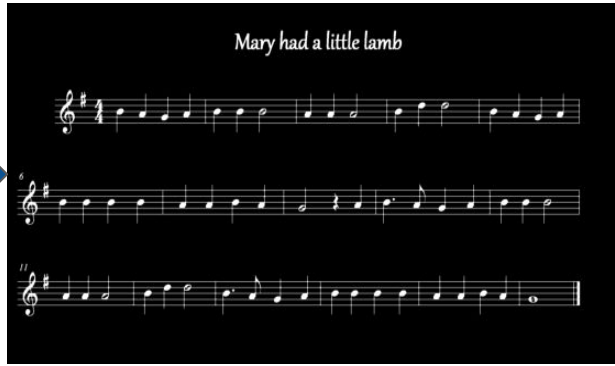
# Segmentation and preprocessing




Original Image

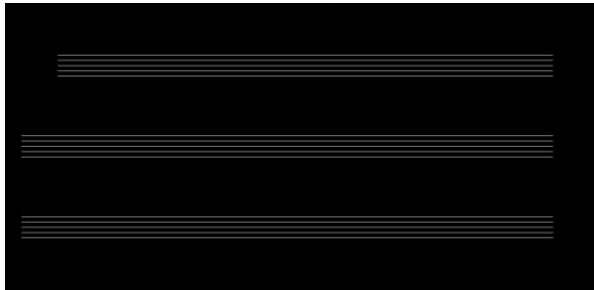



Binarized using Otsu's Method




Inverted Image

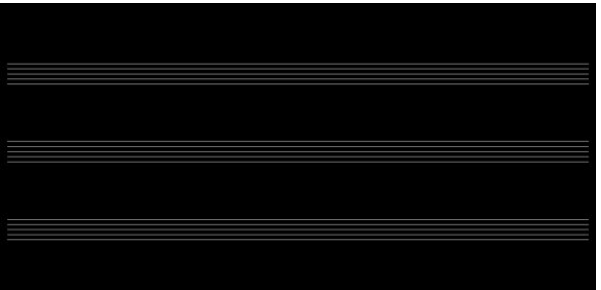
Eroded image with only staff



Horizontal Projection Image

Vertically Eroded

# Segmentation and preprocessing



**Use Both to obtain Image Segments and Staff lines positions**

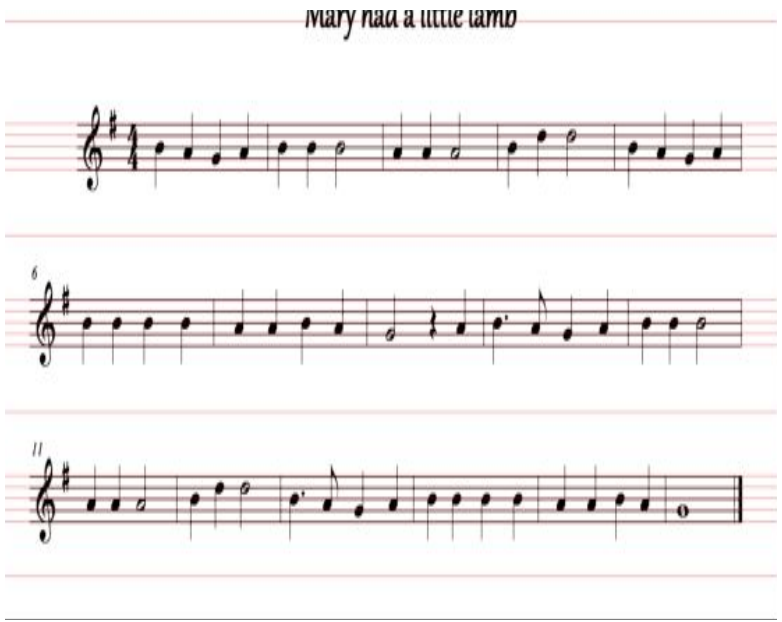
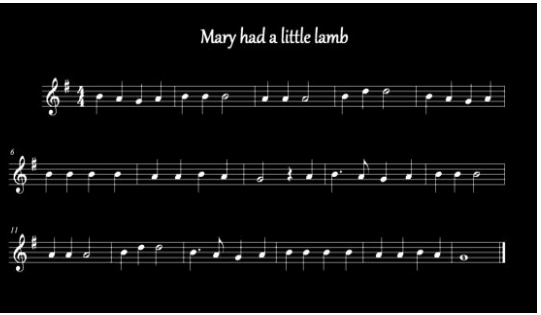
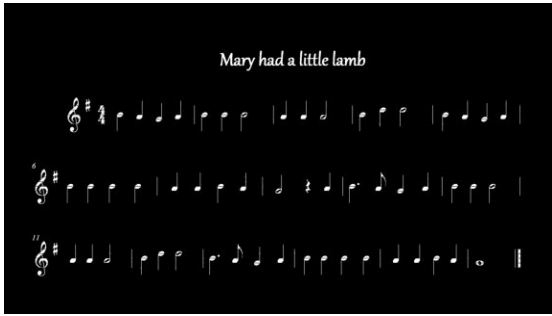



**Image Segments and staff line positions are used by audio synthesizer later**

# Segmentation and preprocessing



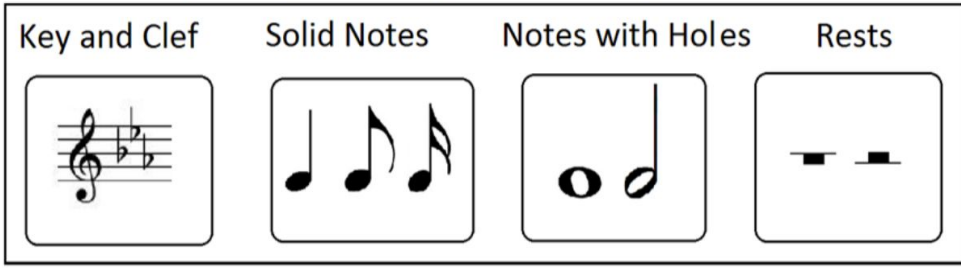

**Binary Image**

**Staff Lines Position**

**Only notes with no lines**

**Next block:**
**Object detection**

# Object detection




- Object of interest are detected using several different morphological operations. The object of interest mainly are the notes, clef, and key signature.
- **Clef detection:** Helps identifying the clef of the music (treble or bass for this application) is simplified by the fact that the clef is always the first object drawn on the left side of the staff
- **Key signature identification**: The left boundary of the key signature was found in a similar manner to the boundary of the clef. The vertical sums of pixels were taken and then the boundaries were determined to be the major transitions in intensity levels. The right boundary was taken as a fixed width guaranteed to at least contain the whole key signature

# Object detection

- **Whole note and half note detection**: The key idea is to fill up the holes in an image and then subtract this from the original image in order to get the image which has non-filled notes present.
- **Detecting Dotted Notes:** The method for dotted note detection is as follows. We first segment the image into each of the individual staffs. The vertical lines and the horizontal lines are removed to give a decomposed image consisting of only the accidental, whole and solid notes as well as the flags.
- **Detecting Rests:** Many of the rests are rectangular elements that are present in an image. In order to detect these, we take our input as the horizontal and vertical line removed image.

# Music synthesis

- Once the whole notes, quarter notes, and half notes are identified, the next step is to identify the note location and get the frequency of the corresponding notes.
- An additive synthesis algorithm is used.
- The parameters we use in this are the envelope of the instrument as well as the temporal envelope of the volume dynamics.
- These give a sense of naturalness to the sound.