Note Sheet Reader

Final Project by Eyal Ronel
Let’s make a computer see

- Already proved to be extremely difficult

- …unless the domain is limited and restricted
Feasible!

• Printed characters – widespread (OCR)
• How about music sheets? ♫
  – Voices recorded as music and played back
  – Music converted to MIDI and played back
  – MIDI converted to note sheets…
  – Does anyone convert note sheets to MIDI?
    • I will! 😊
How do you recognize music?

- Notes are black circles positioned on black horizontal lines.
- Note stems and bar lines are black vertical lines that cross black horizontal lines.
- Specific symbols:
- One step at a time.
Task List

• Recognize staves
• Find the minimal *space* between staff lines
• Gather fives of lines conforming to said *space*
• Find bar lines
• Recognize round shapes roughly the height of *space*
• Distinguish filled circles from empty ones
• Detect stems protruding from circles
• Detect dots to the right of circles
• Detect other symbols: flat sign, sharp sign, rests, …
Look for horizontal lines

• Assuming the page is straight.
• Look for lines that are at least 80% dark.
• Count fives with minimal distance and denote them staves.
• Wipe ‘em out!
How are we so far

Not so bad.
What now? Vertical lines!

- Recognize staves
- Find the minimal space between staff lines
- Gather fives of lines conforming to said space
- **Find bar lines**
- Recognize round shapes roughly the height of *space*
- Distinguish filled circles from empty ones
- Detect stems protruding from circles
- Detect dots to the right of circles
- Detect other symbols: flat sign, sharp sign, rests, …
Same principle

• Just make sure you don’t recognize note stems as bar lines by mistake!

Random misconceptions
Mom, look! No lines!
Recognize dark shapes
Reference Note Heads

- Filled note head
- Empty note head
- Whole note

Can you find any of these here?

Red means “ignore as background”
Handling notes

- Find its stem
- Find its position on the staff
- Search for dots
Announce its identity

• A quarter note C!
Lilypond does the rest

\version "2.1\textbackslash Q\textbackslash Q"

\TheMusic = { \tempo 4=8Q c'4 }

\score { 
  \new Voice {\TheMusic} 
  \midi {} 
  \layout {} 
}
Problems yet to be solved

• Better note head recognition
• Correct detection of tails
• Handling sharps and flats, rests

• And this is only the beginning…
But hey,

it was a nice experience

Thank you for listening ♫