

SHEET MUSIC READER

Gradinariu Robert-Iulian

Grupa 30233 CTI



Descrierea proiectului

Proiectul presupune procesarea unei imagini cu partituri muzicale si redarea notelor acestora prin intermediul duratei si inaltimilor.

Abordarea generala pentru acest proiect ar fi:

- 1. Binarizarea automata a imaginii folosind metoda lui Otsu**
- 2. Segmentarea imaginii ce presupune detectarea liniilor de portativ pe baza histogramei orizontale**
- 3. Stergerea acestor portative pentru procesul de inchidere a notelor (dilatare + eroziune)**
- 4. Stergerea bastonaselor notelor si identificarea inaltimii , respectiv a duratelor acestora.**

Publicatii asemanatoare despre acest proiect

Autori : Yuan-Hsiang Chang, Zhong-Xian Peng, Li-Der Jeng.

Acestia au abordat problema astfel:

- 1. Convertirea imaginii intr-o imagine binara**
- 2. Aplicarea proiectiei orizontale (histograma)**
- 3. Segmentarea regiunii pentru procesarea independenta**
- 4. Indepartarea liniilor de portativ**
- 5. Utilizarea operatiei de inchidere morfologica**
- 6. Etichetarea componentelor conexe pentru identificarea notelor**
- 7. Indepartarea stemurilor**
- 8. Filtrarea dimensiunii notelor dupa liniile de portativ**
- 9. Detectarea headurilor notelor prin calcularea simetriei**
- 10. Clasificarea notelor pe baza pozitiei lor fata de portative si in functie de proprietatile lor (solid,stem, numar de cozi).**
- 11. Recunoasterea accidentelor si pauzelor care modifica nota (diez, bemol si natural).**

Easy piano

Oh, Susanna

Arr. Peter Edvinsson

Stephen Foster

The sheet music is arranged in four systems, each with a treble and bass staff. The key signature is one flat (B-flat), and the time signature is 4/4. Chords are indicated by letters C, G7, and F above the treble staff. The piece ends with a double bar line.

System 1: Treble staff starts with a C chord. Bass staff has a whole note G2 and a whole note B1. Treble staff has a quarter note G4, a quarter note A4, a quarter note B4, and a quarter note C5. Bass staff has a whole note G2 and a whole note B1.

System 2: Treble staff starts with a C chord. Bass staff has a whole note G2 and a whole note B1. Treble staff has a quarter note G4, a quarter note A4, a quarter note B4, and a quarter note C5. Bass staff has a whole note G2 and a whole note B1.

System 3: Treble staff starts with a C chord. Bass staff has a whole note G2 and a whole note B1. Treble staff has a quarter note G4, a quarter note A4, a quarter note B4, and a quarter note C5. Bass staff has a whole note G2 and a whole note B1.

System 4: Treble staff starts with a C chord. Bass staff has a whole note G2 and a whole note B1. Treble staff has a quarter note G4, a quarter note A4, a quarter note B4, and a quarter note C5. Bass staff has a whole note G2 and a whole note B1.

Imaginea initiala

Rezultate ale operatiilor de mai sus:

1. Binarizarea

Free sheet music - Capotasto Music

Easy piano

Oh, Susanna

Arr. Peter Edvinsson

Stephen Foster

C G7

C G7 C F

C G7

C G7 C

2. Dilatarea

Free sheet music - Capotasto Music

Easy piano

Oh, Susanna

Arr Peter Edvinsson

Stephen Foster

Sheet music for 'Oh, Susanna' by Stephen Foster, arranged by Peter Edvinsson. The music is in 4/4 time, key of C major, and is marked 'Easy piano'. It consists of four systems of two staves each (treble and bass clef). The melody is in the treble clef, and the accompaniment is in the bass clef. Chords are indicated by letters C, G7, and F above the staff.

3. Erodarea

Free sheet music - Capotasto Music

Easy piano

Oh, Susanna

Arr: Peter Edvinsson

Stephen Foster

The musical score is written for piano in 4/4 time. It consists of four systems of music. Each system has a treble and bass staff joined by a brace. The melody is in the treble staff, and the accompaniment is in the bass staff. Chords are indicated by letters C, G7, and F above the treble staff. The piece ends with a double bar line.

Chords: C, G7, C, F, C, G7, C

4. Imaginea fara Linii de portativ si bastonasele notelor

Free sheet music - Capotasto Music

Easy piano

Oh, Susanna

Arr: Peter Edvinsson

Stephen Foster

The musical score is presented in four systems, each containing a treble and bass staff. The key signature is one sharp (F#) and the time signature is 4/4. Chord symbols (C, G7, F) are placed above the staff at various points. The music is written in a simple, accessible style suitable for beginners.

5. Imaginea finala procesata

Free sheet music - Capotasto Music

Easy piano

Oh, Susanna

Art Project Evaluation

Stephen Foster

[illegible]

The image shows the first 12 measures of a musical score for 'The Alphabet Song'. The score is written on a grand staff (treble and bass clefs). The key signature is one flat (B-flat). The time signature is 4/4. The chords indicated above the staff are C, G7, C, and F. The notes are color-coded: red for half notes, blue for quarter notes, and black for eighth notes. The lyrics 'MI DO RE MI RE DO SI LA' are written below the notes.

The first system of the musical score for 'The Rose Tree' is shown. It consists of a treble and bass staff. The treble staff has a key signature of one flat (B-flat) and a common time signature (C). The melody begins with a quarter note G4 (labeled 'LA' in red), followed by a quarter note A4 (labeled 'LA' in red), and a quarter note G4 (labeled 'LA' in red). The bass staff has a key signature of one flat (B-flat) and a common time signature (C). The bass line begins with a quarter note F3 (labeled 'RE' in red), followed by a quarter note E3 (labeled 'DO' in red), and a quarter note D3 (labeled 'DO' in red). The system ends with a double bar line.

The first system of the musical score for 'The Rose Tree' is shown. It consists of a treble and bass staff. The treble staff has a key signature of one sharp (F#) and a common time signature (C). The melody begins with a quarter note G4 (labeled 'MI'), followed by a quarter note A4 (labeled 'SOL'), a quarter note B4 (labeled 'SOL'), and a quarter note C5 (labeled 'LA'). The bass staff begins with a quarter note G3 (labeled 'LA'), followed by a quarter note A3 (labeled 'DO'), a quarter note B3 (labeled 'DO'), and a quarter note C4 (labeled 'LA'). The system is divided into three measures by bar lines. The first measure contains the notes G4, A4, B4, and C5 in the treble, and G3, A3, B3, and C4 in the bass. The second measure contains the notes A4, B4, C5, and D5 in the treble, and A3, B3, C4, and D4 in the bass. The third measure contains the notes B4, C5, D5, and E5 in the treble, and B3, C4, D4, and E4 in the bass. The system ends with a double bar line.

Detalii de implementare

- Crearea unei structuri pentru retinerea informatiilor despre nota : clasa **Rectangle** ce retine informatii despre inaltime, latime , pozitia stanga-sus a dreptunghiului ce delimiteaza nota, centrul prin coordonatele **X** si **Y**, daca are bastonas , daca e plina sau nu si daca a fost gasita prin procesul de iterare peste imagine.
- Imaginea este preprocesata (binarizata), respectiv segmentata fata de liniile portativului pentru o procesare mai lina.
- Se aplica algoritmul de labeling pentru etichetarea notelor care duce la o recunoastere mult mai usoara.
- Se aplica operatiile morfologice de dilatare/erodare pentru procesul de inchidere a notelor.
- Inaltimea notei este determinata cu ajutorul distantei de la centrul sau pana la cea mai apropiata linie de portativ.
- Se calculeaza si tipul notei care poate fi nota intreaga sau nu, doime sau patrice.
- Pentru liniile mai groase de portativ care ar putea duce la erori in calcularea inaltimilor notelor, acestea se subtiaza la o linie de doar un pixel grosime.
- Se calculeaza durata notei pe baza caracteristicilor determinate.
- Se sorteaza vectorul de note de la dreapta la stanga si de sus in jos pentru o parcurgere normala a notelor atunci cand sunt redade auditiv.
- Ultimul pas a fost evidentierea caracteristicilor notelor direct pe poza pentru o intelegere mai usoara.

Manual de utilizare

Proiectul se ruleaza din Visual Studio. Rularea se bazeaza pe o imagine preincarcata din folderul cu imagini ale proiectului.

Concluzie

Extragerea notelor a fost un proces interesant prin care am intrat in acest domeniu imens a procesarii imaginilor, de la simple reprezentari pe “hartie” pana la reprezentarea audio.

Programul functioneaza cu o acuratete destul de buna, dificultatile intalnite fiind zgomotul din imagine si nivelul de detaliu a notelor care pot incurca in prezicerea simbolurilor .

