



Guitar Tablature Estimation

Nick vd Linden s2971976



What is guitar tablature?

The image displays two systems of musical notation. Each system consists of a standard musical staff and a guitar tablature staff. The first system is in C major, indicated by a treble clef and a common time signature (C). The musical staff shows a sequence of notes: C4, D4, E4, F4, G4, A4, B4, C5, D5, E5, F5, G5, A5, B5, C6. The corresponding guitar tablature staff shows the fret numbers for each note: 2, 5, 3, 5, 2, 2, 2, 5, 5, 5, 2, 2, 2. The second system is marked with a '5' above the treble clef, indicating a fifth fret shift. The musical staff shows notes: G5, A5, B5, C6, D6, E6, F6, G6, A6, B6, C7, D7, E7, F7, G7. The corresponding guitar tablature staff shows fret numbers: 2, 5, 3, 5, 2, 2, 2, 3, 5, 5, 2, 5, 3.

Why Automatic Guitar Transcription?

- Problems with human-made tabs

```
melodies and have strong strumming sections.
Intro
Strummed, dampen with LH
  v      v ^ v      v ^ v
|-----|-----|-----|
|---x---|---0---x---0---x---|
|---0---x---|---0-0-0---x---0-0-0---x---|
|---0---x---|---0-0-0---x---0-0-0---x---|
|---0---x---|---0-0-0---x---0-0-0---x---|
|---(0)-x---|---(0)-(0)-x---(0)-(0)-x---|
  p          p i p      p i p
x1-3

Verse:
pick or strum
s-s      s-----s
s
|-----|-----|-----|
|---0---2/4---|---4---4/2---|
|---0-2---|---0---4---|
|---2---0-2---|---0-2/4---0---2/4---4---4/2---|
|---0-2---|---2-(0)(0)(0)-|
|---2---0---|-----0---|
|-----0-(0)0---|-----0---|
  i i m m p i p      p m p i m
m m i p m i p i p
p p p p p (p)
2nd time
s-s      s-----s
s
|-----|-----|-----|
|---0---2/4---3---2-0---|---4---4/3---|
|---0-2---|---0---0---|
|---2---2-0---0-2---|---0---4/3---|
|---0-2/4---0---2/4---4---|-----4/3---|
|---2/4-3---0---2/4-4---|---0---| x2
|---0-2---|---0---2---|---0---|
|-----0---|-----0---|
  m m m m p a      p a m
m m m m m a      p a m
i p p i m
i
```

Why this is challenging



Previous work

- Gregory Burlet and Ichiro Fujinaga. Robotaba guitar tablature transcription framework. In Proceedings of the 14th International Conference on Music Information Retrieval (ISMIR), Curitiba, Brazil, 2013
- Gregory Burlet and Abram Hindle. Isolated guitar transcription using a deep belief network. PeerJ Computer Science, 3:e109, 201
- Kazuki Yazawa, Katsutoshi Itoyama, and Hiroshi Okuno. Automatic transcription of guitar tablature from audio signals in accordance with player's proficiency. In 2014 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), pages 3122–3126. IEEE, 201
- Kazuki Yazawa, Daichi Sakaue, Kohei Nagira, Katsutoshi Itoyama, and Hiroshi G Okuno. Audio-based guitar tablature transcription using multipitch analysis and playability constraints. In 2013 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), pages 196–200. IEEE, 201

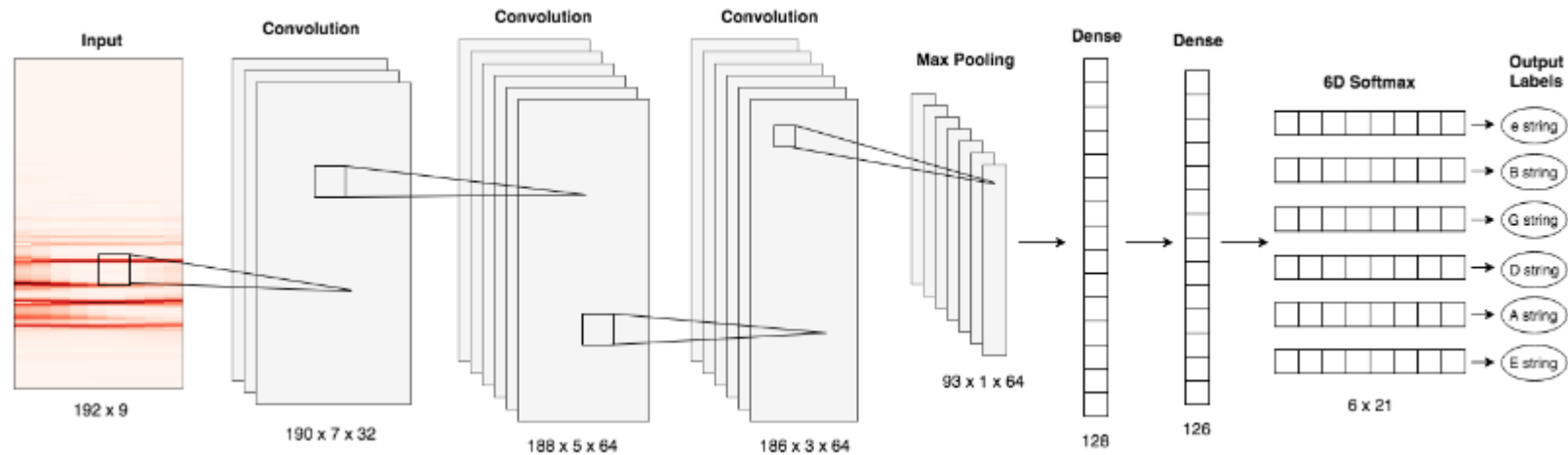
Table of Contents

- Methodology
- Evaluation
- Results
- Discussion
- Conclusion

Dataset

- Recording
- Audio pre-processing
- Label pre-processing

The network



Evaluation

- Multi pitch Metrics

$$p_{\text{pitch}} = \frac{e^T(Y_{\text{gt}} \odot Y_{\text{pred}})e}{e^T Y_{\text{pred}} e}$$

$$r_{\text{pitch}} = \frac{e^T(Y_{\text{gt}} \odot Y_{\text{pred}})e}{e^T Y_{\text{gt}} e}$$

$$f_{\text{pitch}} = \frac{2p_{\text{pitch}}r_{\text{pitch}}}{p_{\text{pitch}} + r_{\text{pitch}}}$$

- Tablature Metrics

$$p_{\text{tab}} = \frac{e^T(Z_{\text{gt}} \odot Z_{\text{pred}})e}{e^T Z_{\text{pred}} e}$$

$$r_{\text{tab}} = \frac{e^T(Z_{\text{gt}} \odot Z_{\text{pred}})e}{e^T Z_{\text{gt}} e}$$

$$f_{\text{tab}} = \frac{2p_{\text{tab}}r_{\text{tab}}}{p_{\text{tab}} + r_{\text{tab}}}$$

- TDR

$$TDR = \frac{e^T(Z_{\text{gt}} \odot Z_{\text{pred}})e}{e^T(Y_{\text{gt}} \odot Y_{\text{pred}})e}$$

Results

System	p_{pitch}	r_{pitch}	f_{pitch}
TabCNN	0.900 \pm 0.016	0.764 \pm 0.043	0.826 \pm 0.025
Deep Saliency	0.778 \pm 0.092	0.562 \pm 0.099	0.646 \pm 0.078

Table 1. Multipitch estimation metrics for our system, TabCNN, compared against a baseline, the Deep Saliency f0-estimation algorithm introduced in [4], from experiments carried out in [24]. For all metrics, we report the mean and standard deviation over the entire dataset.

Results

System	p_{tab}	r_{tab}	f_{tab}	TDR
TabCNN	0.809 \pm 0.029	0.696 \pm 0.061	0.748 \pm 0.047	0.899 \pm 0.033

Table 2. Tablature estimation results for the proposed system, TabCNN, using the metrics we introduce to measure performance in fingering prediction. For all metrics, we report the mean and standard deviation over the entire dataset.

Discussion

- Common errors
 - False Alarms
 - Missed Detection
 - Miss Frettings
- Temporal Smoothing

Conclusion

- Future work
 - end-to-end transcription program
 - temporal smoothing