Australian National University

ASSIGNMENT COVER SHEET

Submission and assessment is anonymous where appropriate and possible. Please do not write your name on this coversheet.

This coversheet must be attached to the front of your assessment when submitted in hard copy. If you have elected to submit in hard copy rather than Turnitin, you must provide copies of all references included in the assessment item.

All assessment items submitted in hard copy are due at 5pm unless otherwise specified in the course outline.

Student ID

For group assignments, list each student's ID	U5012063
Course Code	ENGN 4200
Course Name	Individual Project
Assignment number	1
Assignment Topic	Thesis registration
Lecturer	Wojciech Lipinski
Tutor	N/A
Tutorial (day and time)	N/A
Word count	Due Date 9/9/19
Date Submitted 7/8/19	Extension Granted N/A

I declare that this work:

☑ upholds the principles of academic integrity, as defined in the ANU Policy: Code of Practice for Student Academic Integrity;

☑ is original, except where collaboration (for example group work) has been authorised in writing by the course convener in the course outline and/or Wattle site;

☑ is produced for the purposes of this assessment task and has not been submitted for assessment in any other context, except where authorised in writing by the course convener;

☑ gives appropriate acknowledgement of the ideas, scholarship and intellectual property of others insofar as these have been used;

☑ in no part involves copying, cheating, collusion, fabrication, plagiarism or recycling.

Initials

For group assignments, each student must initial.

Individual Project Registration

ENGN4200

Note: this form must be completed with a text editor (font 11 pt, Arial) by the student and signed by the student, the supervisor and the secondary supervisor/examiner.

STUDENT

Surname:	Ignetik
First name:	Oliver
Uni ID:	U5012063
Email address:	U5012063@anu.edu.au
Contact phone #:	0479132542
Enrolled units:	ENGN 4200, ENGN 3230

SUPERVISER

Surname:	Sadeghi
First name:	Parastoo
Uni ID or "External":	u4267276
Email address:	parastoo.sadeghi@anu.edu.au
Contact phone #:	N/A

SECONDARY SUPERVISER/EXAMINER

Surname:	TBA
First name:	I have discussed the matter with my primary supervisor
Uni ID or "External":	
Email address:	
Contact phone #:	

PROJECT (Maximum two pages)

Please clearly identify your project context, specific research question, the scope of your project and key elements of previous work. It is important to be able to articulate the specific research question being posed to ensure further research and effort are leading to answering that question.

1. **Title**
   Polyphonic Automatic Music Transcription (AMT)

2. **Research question:**

   Is it possible to improve the performance of AMT systems in polyphonic environments by incorporating higher level musical knowledge into current methods?

3. **Background context/ Initial scope of project:**

   Automatic Music Transcription (AMT) is the process of converting an acoustic music signal into some form of music notation. AMT is a fundamental problem in the field of music signal processing with applications ranging from improving perception of music amongst cochlear implant users to educational usage in developing aural transcription skills [Benetos et al, 2019].

   The initial scope of this project will be based around exploring and improving the performance of AMT methods in a polyphonic/ multi-instrument environment. AMT systems are still far below the level of human experts especially in multiple-instrument environments [Benetos et al, 2013]. This project will focus on Western music, ignore percussive instruments such as drums and timpani's and explore how musical knowledge can improve the performance of these systems. The motivation for this project stems from a clear indication in the literature that most transcription approaches are data-driven and as such cause many errors that are not musically meaningful [Duan et al, 2015].

   AMT has close relations with speech processing as both tasks involve converting acoustic signals to symbolic sequences the difference being that musical sources are highly correlated in time and frequency. This being the case there are a number of key challenges in the field which include: complex mixture signals with a significant harmonic overlap, the fact that sources cannot be statistically independent due to the synchronization of onsets and onsets between different sources and the lack of large universally verified datasets containing ground truth transcriptions [Schedl et al, 2019].

   Most approaches in AMT are designed to reach an intermediate goal in audio-music notation transcription that does not actually resemble musical notation, i.e. a Musical Instrument Digital Interface (MIDI). These methods work on different levels on transcription ranging from frame estimation of pitches, note estimation, stream/instrument estimation and finally notation level transcription, which most closely resembles the end goal of AMT [Benetos et al, 2019].

   There are several commercial AMT software on the market such as Melodyne, AudioScore and Transcribe!. However, these systems underperform in polyphonic environments and the conversion of

the MIDI files to musical notation is unsatisfactory amongst musicians [Zuan et al, 2015]. There have been recent attempts to develop end-to-end neural networks that convert audio signals directly to music transcription [Sigtia et al, 2019]. This article and others relating to modelling Musical Language Models (MLM) [Carvalho et al, 2019] will serve as a useful entry point in this project as the end goal is to incorporate musical knowledge into current methods. One final source of inspiration for this project will be recent work done on score and lead sheet informed transcription, whereby AMT systems are given a prior before the performance to aid with transcription. This is an underdetermined problem and recent work has shown that this can considerably improve performance of AMT systems [Wang et al, 2017]. Musical transcription is an incredible feat of human intellect and by incorporating some approaches that humans use into existing models the author hopes that this will improve the performance of such models.

4. Deliverables

- Reproduce results of selected AMT methods due September 15th
- Mid-term report due 25th October 2019
- Thesis presentation due 18th May 2020
- Thesis report due 29th May 2020
- Optional: Conference paper due 29th May 2020

5. Key references

- E. Benetos, S. Dixon, Z. Duan, S. Ewert, "Automatic Music Transcription", in IEEE SPS Journal Vol. 36 January
- E. Benetos, S. Dixon, D. Giannoulis, H. Kirchhoff, and A. Klapuri, "Automatic music transcription: Challenges and future directions," J. Intelligent Inform. Syst.,vol. 41, no. 3, pp. 407–434, 2013.
- M. Schedl, E. Gómez, and J. Urbano, "Music information retrieval: Recent developments and applications," Foundations Trends Inform. Retrieval, vol. 8, pp. 127–261, 2014. doi: 10.1561/1500000042.
- R. G. C. Carvalho and P. Smaragdis, "Towards end-to-end polyphonic music transcription: Transforming music audio directly to a score," in 2017 IEEE Workshop Applications Signal Processing Audio and Acoustics, 2017, pp. 151–155.
- S. Sigtia, E. Benetos, and S. Dixon, "An end-to-end neural network for polyphonic piano music transcription," IEEE/ACM Trans. Audio, Speech, Language Process., vol. 24, no. 5, pp. 927–939, 2016.
- S. Wang, S. Ewert, and S. Dixon, "Identifying missing and extra notes in piano recordings using score-informed dictionary learning," IEEE/ACM Trans. Audio, Speech, Language Process., vol. 25, no. 10, pp. 1877–1889, 2017.
- Z. Duan, E. Benetos, "Automatic Music Transcription", Tutorial at ISMIR 2015, available: http://c4dm.eecs.qmul.ac.uk/ismir15-amt-tutorial/ [Accessed 3/8/2019]

RESPONSIBILITIES

STUDENT

- Must adhere to the deliverable deadlines set out in this agreement
- Must comply with the University's policies and procedures in terms of applying for assessment item/deliverable extensions and/or deferred assessments.
- Must attend all scheduled meetings with your Primary and/or Secondary Supervisor, as per your written agreement. If you are unable to attend a scheduled meeting, you will (where practicable) provide your supervisor with prior notice of your unavailability to attend.
- Must understand and exercise the Academic Integrity requirements of the ANU.
- Must provide regular feedback on your progress to your Primary Supervisor and report any challenges which could impact your ability to successfully complete your project (e.g. Health concern).
- Must report any concerns which could be considered significant (e.g. harassment/bullying, Primary Supervisor becomes unresponsive) directly to the Course Convener.

PRIMARY SUPERVISOR

- Have a duty of care to the student and must ensure projects are scoped appropriately.
- Must establish regular (weekly or fortnightly) progress meetings with your student, which are agreed in writing (email is sufficient).
- Must maintain regular contact with the student. If a student under your supervision is unresponsive and/or does not attend 2 scheduled meetings in a row without prior explanation, the Supervisor must:
  - Notify the student in writing that they are at risk of breaching their Individual Project Study Contact agreement and provide a deadline for response; and
  - Contact the Course Convener and CECS Student Services so a record can be made.
- Must provide regular feedback, assistance and guidance to students and ensure that the student has access to resources required to complete their project.
- Must advise the student, the Secondary Supervisor and the Course Convener immediately if you are unable to continue supervision and/or if you plan travel for longer than 2 weeks and/or which could reasonably be expected to impact on your ability to supervise the student.
- Must collate all feedback and assessment marks for project deliverables from the Secondary Supervisor and provide final assessment marks to the Course Convener in accordance with CECS result approval deadlines.
- Must communicate any known issues or concerns relating to the student's progress or welfare to the Course Convener.
- Must attend the poster presentation
- Nominate the second supervisor / examiner – can be in discussion with student.

SECONDARY SUPERVISOR/ EXAMINER

- Have a duty of care to the student
- Must liaise regularly with the Primary Supervisor regarding feedback of project deliverables and marking of assessment items.
- Must submit all assessment marks and feedback to the Primary Supervisor in accordance with CECS result approval deadlines.
- Must advise the student and the primary supervisor immediately if you are unable to continue in your role as secondary supervisor and/or if you planning travel for longer than 2 weeks and/or which could reasonably be expected to impact on your ability to supervise the student and/or provide assessment marks.
- Must report any concerns which could be considered significant (e.g. harassment/bullying, primary supervisor becomes unresponsive) in relation to the student and/or their supervision directly to the course convener.

Australian National University

DECLARATIONS

STUDENT

1. I certify that the information I have given in this contract is complete, accurate and truthful.
2. I have read and understood the obligations that apply to me as the student, as well as the requirements of my supervisors and the course convener.
3. I agree to fulfil the obligations of this contract.

....7/8/19..............
Signature   Date

PRIMARY SUPERVISOR

1. I certify that the information I have given in this contract is complete, accurate and truthful.
2. I have read and understood the obligations that apply to me as the primary supervisor, as well as the requirements of the student, the secondary supervisor/ examiner and the course convener.
3. I have reviewed the aforementioned student's academic transcript and assess this student to be suitable to complete the project detailed above.
4. I agree to provide supervision and support to the aforementioned student for the duration of the project.
5. I agree to fulfil the obligations of this contract.

....7 Aug 2019...........
Signature   Date

SECONDARY SUPERVISOR / EXAMINER

1. I certify that the information I have given in this contract is complete, accurate and truthful.
2. I have read and understood the obligations that apply to me as the secondary supervisor, as well as the requirements of the student, the primary supervisor and the course convener.
3. I have reviewed the aforementioned student's academic transcript and assess this student to be suitable to complete the project detailed above.
4. I agree to provide secondary supervision and support to the aforementioned student for the duration of the project.
5. I agree to fulfil the obligations of this contract.

TBA (discussed with primary supervisor)

....
Signature   Date