MUS421: Introduction to Music Informatics

Tuesday, Thursday, 10:15-11:30
3 Credit Hours

Instructor: **Martin McCrory**
Office Location: Music Building 244
Email: mccrory@indiana.edu
Phone: (999) 555-6789

Prerequisites: MUS202: Music Theory 4th semester,
MUS300: Music Technology and
Senior Standing.
No computer programming experience required!

Office Hours: **Tuesday, Thursday 2-3:30pm**
If you are unavailable during these times, please contact me and I'd be happy to arrange an alternative time to meet with you. I enjoy teaching and I really would like to get to know all of you better, so please don't hesitate to stop by for any reason.

Course Description: One of the main purposes of this course is for you to explore exactly what the nebulous field of "Music Informatics" represents, and what issues are relevant to the study of Music Informatics.

Once we've pinned down some of these relevant Music Informatics issues, we'll learn what technological tools already exist (and what tools are being developed) and how they work, in order to help us better understand MI and the issues that surround it. Lastly, you'll learn how to use these pre-existing tools to create new solutions to new and existing problems.

Specific Music Informatics-related topics we'll cover include:

- Music Information Representation – Symbolic and Audio
- Survey and design of Music Information Retrieval Algorithms
- Copyright laws and Intellectual Property Rights
- Creating new hardware and software tools for music performance

You'll work individually and in groups during this process. You'll read case studies, write a few short papers and give a group oral presentation. There are two short answer/essay exams—one (easier) at the beginning of term and one (harder) final exam at the end of term. In the end you'll gain a fuller understanding of the complex relationships among technology, music, sound, consumers, composers, computer techies and just about anyone or anything having anything to do with the musical and technological world we live in today.

Course Objectives:

Upon completion of this course, you should be able to:

1. Define what Music Informatics is from a holistic, real-world perspective,
2. Gain an understanding of the relationship between technology and music in today's world,
3. Understand and describe technological tools that already exist (and what tools are being developed) related to Music Informatics topics, and lastly,
4. Use these tools to develop solutions of your own to real-world problems involving music and technology.

Course Goals:

My hope is that you set a goal for yourself that goes something like this: upon completion of this course, I will have a much broader, deeper, big-picture understanding of the extent to which technology and music influence each other today, and why this is so.

Teaching Methods:

This course will mainly be taught using problem-based teaching techniques. That is to say, I'm not going to be lecturing you from "behind the podium" very often. Instead, you'll gain your declarative knowledge from a respectable amount of weekly reading/hands-on work outside of class.

In class, you'll interact heavily with me and your classmates doing things like case study analyses, policy debates, media viewing and creating, and much more. I will lecture with PowerPoint on a minimal basis, using lecture materials mostly as a launching pad for your ideas and discussions on issues.

My job in the classroom is to point you in the right direction and answer any questions you have about the material. That said, the classroom environment will be sufficiently structured so that you don't feel lost, confused or out of place. I will do my best to make sure that everyone ends the day on the same page, so to speak.

Attendance Policy:

In a class such as this, everyone learns best when everyone is present. Good discussions can't happen when much of the class is missing. Not to mention that you miss out on the most vital part of the learning experience when you skip class. Therefore, this class has an attendance policy that is stricter than most. You get two free unexcused absences. After that, each unexcused absence earns you a reduction in your overall grade by 3 percent.

Tardiness Policy:

It is extremely disruptive to walk into class after class has started. I will start class on time every day and I expect you to be in the classroom, finished shuffling your coats and papers by that time as well. If chronic tardiness becomes a problem, I will lower your participation grade at my discretion.

Laptop Policy:

There is a strict no-laptops policy in this class. If you are using your laptop to check Facebook or email your significant other during class, you may as well have stayed home that day. You can put your laptop away for 75 minutes, 2 days/week. Exceptions will of course be granted when we are discussing materials retrieved from the internet or from computer programs.

Class Atmosphere:

This promises to be a lively class, with many discussions on both straightforward and controversial issues. While in my classroom, I expect you to be respectful of everyone's ideas, whether you agree with them or not. If you can remember to substantiate your arguments and keep an open mind, everyone will have a greater opportunity to learn. You're all adults, either on the way to graduate school or the professional world, and I will treat you with the respect that your status deserves—just promise that you will do the same for your classmates.

Required Text:

There is no required textbook for this class. I will make case studies, readings and other hands-on exercises available on the course website and occasionally via hard copy. You are expected to complete the assigned case study readings before the class in which we discuss it, as this will allow for good classroom discussion to take place.

Additional Materials:

As above, I will make any additional materials, such as sound clips, music, videos and computer programs available on the course website.

Grading:

First exam:	10%
Three Individual Unit Papers:	30% (10% each)
One Group Unit Presentation:	25%
Last exam:	25%
Participation:	10%

Grading Policies:

Case Studies

There will be short case studies assigned for almost every class. These readings serve to illustrate relevant and interesting examples of the material discussed in class. While the case studies generally will be short, entertaining and easy (often simply reading a few web pages, experimenting with an online tutorial or something like that) I do expect that you will arrive in class with the assigned case study readings completed. Your understanding of the case study examples is critical to fostering good class discussion. While I will not be grading you directly on whether or not you have read each case, your participation grade may suffer if you come to class unprepared for discussion.

Initial Assessment (50 minutes)

The purpose of the Initial Assessment is for both you and me to gain our footing in the course, so to speak. You'll get an idea of what kinds of things you'll be thinking about in this course, and I'll get an idea of what to bring to the table. As such, it will be graded "easy," with a focus on your ability to think critically (but without BSing) given a topic which you may not yet be completely comfortable. The questions on the first exam will be in short answer and essay form, asking you to address a theoretical issue or real-world problem related to Music Informatics. The exam will be open-note, open-laptop, open-just-about-anything—but not open-friend!

Unit Papers

You will do THREE of these, one for each unit in which you are NOT giving a Unit Presentation in your group. These will be 750-1250 word essays that offer a

solution or prototype model to a real-world Music Informatics problem related to the Unit in which the paper was assigned. We will discuss specific paper topics during the Unit itself.

Papers are due on the course website at 9pm the day they are due. For every 24 hours your paper is late, at the beginning of that 24 hour period, I will subtract 5% from the paper's grade. Extensions will only be granted in extenuating circumstances.

Unit Presentation
You will do ONE of these, in a group and during a unit that I assign to you after the first exam. These will be 20 minute (with an additional 5 minutes for Q&A) group presentations on a topic of your choice related to the Unit in which the presentation was assigned. I will provide a grading rubric to all groups for the oral presentations a few weeks into the semester.

Last Exam (150 minutes)
The last exam will be similar in structure to the initial assessment (short answer and essay questions), but with a greater emphasis on the technical skills you've learned, and on real-world problem solving. This will be graded "harder" than the initial assessment, but by this point you will have obtained sufficient knowledge and skills so that you will be able to tackle this exam with no problem. Like the initial assessment, the final exam will be open-note, open-laptop, open-just-about-anything—but not open-friend!

Participation
Your participation grade is influenced most by your attendance, participation in day-to-day group work, comprehension of the cast study readings and your attentiveness in class. A student who does the readings, comes to class every day, is genuinely active and helpful in group work and doesn't fall asleep in class or check Facebook has nothing to worry about.

Plagiarism
Plagiarism on any of the unit papers or the unit presentation will automatically result in a grade of zero for that paper or presentation (for everyone in the group), and a zero for your participation grade in the course. Plagiarism on the final exam will result in a zero on the final and a reduction of your overall grade by 50%, which means you'd get an F for the course.

Course Outline, with Assignments:

Week	Unit	Topic	Assignments
8/24 (1)	1	**Overview: What is Music Informatics?** • Discussion of our previous Music Informatics experience and knowledge • What are some issues that we'd like to know more about? • In-class examples of some MI issues	
8/31 (2)	1	**More discussion: What is Music Informatics?** • Discussion of issues brought up last week • How could we use computers to solve these problems? • How can we develop a working definition of MI?	First Exam on Thursday
9/7 (3)	2	***Music Visualization and Representation*** • **Music as Symbols: Sheet music** ○ What it is, how it's used ○ Visualization—Pros and cons of sheet music ○ How do sheet music and computers relate? ○ *Case study: Pre-baroque sheet music, Jimi Hendrix SSB score* • **Music as Symbols: MIDI (Musical Instrument Digital Interface)** ○ What it is, how it's used ○ Visualization—Pros and cons of MIDI ○ *Case study: Three short screenshots of MIDI code, with accompanying audio/midi file*	
9/14 (4)	2	***Music Visualization and Representation*** • **Music as Symbols: Computer code** ○ What it is, how it's used ○ Visualization—Pros and cons of computer code ○ *Case study: sample of R code, sample of .dat representation of mu* • **Music as Symbols: Summary** ○ Why do we choose to represent music as symbols? ○ What kinds of tools can we build using music represented as symbols? ○ *Case study: Case study 5*	
9/21 (5)	2	***Music Visualization and Representation*** • **Music as Audio: Sine Wave** ○ What is a sine wave? ○ How do we use sine waves to form other sounds? ○ *In-class exercises, use online applet* • **Music as Audio: Time-domain audio representations—time/amplitude** ○ What It is, how it's used ○ How is this representation useful? ○ *Case study: techno piece compared to classical piece* • **Music as Audio: Frequency-domain audio representations—frequency/amplitude (FFT)** ○ What it is, how it's used ○ How is this representation useful? ○ *Case study: Comparison of western acoustic instruments' FFTs*	
9/28 (6)	2	***Music Visualization and Representation*** • **Music as Audio: Time-domain audio representations—time/frequency (Piano Roll)** ○ What It is, how it's used ○ How is this representation useful? ○ May spill into next week ○ *Case study: Piano roll thingy, "never ending glissando"* • **Music as Audio: Audio encodings**	Unit 2 paper due Friday 9pm Group A gives presentation on Thursday

		○ Wav, mp3, Ogg/Vorbis, others ○ Audio compression—advantages/disadvantages ○ "Lossy" versus "lossless" encodings • **Music as Audio: Summary** ○ What kinds of tools can we develop using these music visualizations? ○ What kinds of other visualizations can you think of?	
10/4 (7)	3	***Music Information Retrieval*** • **Music Information Retrieval Exchange (MIREX)** ○ What it is, why it exists ○ What the current MIREX contests are ○ Overview of past MIREX contests ○ *Case study: MIREX Wiki* • **MIREX: Classification contests** ○ Artist, genre, tag, mood, cover song ○ How are these algorithms written? ○ How do they work? ○ What is their usefulness? ○ *Case study: Examples of classification from the "real world", read MIREXwiki*	
10/11 (8)	3	***Music Information Retrieval*** • **MIREX: Extraction contests** ○ Chord detection, Melody extraction, Frequency estimation, beat tracking ○ How are these algorithms written? ○ How do they work? ○ What is their usefulness? ○ *Case study: More examples from the "real world", read MIREXwiki* • **MIREX: Retrieval contests** ○ QBS/H, QBT ○ How are these algorithms written? ○ How do they work? ○ What is their usefulness? ○ *Case study: Same as above* • **MIREX: Other contests** ○ How are these algorithms written? ○ How do they work? ○ What is their usefulness? ○ *Case study: Same as above*	
10/18 (9)	3	***Music Information Retrieval*** • **Music Recommendation** ○ Various approaches to recommendation (automatic/manual feature extraction, collaborative filtering) ○ What are the advantages/disadvantages? ○ *Case study: Pandora's website, last.fm website* • **Summary** ○ Review of MIR "building blocks" (the various algorithms) ○ What higher-level tools exist that use these "building blocks"? ○ What kinds of higher-level tools could we invent with these "building blocks"?	Unit 3 paper due Friday 9pm Group B gives presentation on Thursday
10/25 (10)	4	***Copyright Laws and the Relationship between Music Technology and Society*** • **Music Copyright Laws** ○ Discussion of how copyright laws have changed over time ○ Discussion of current laws ○ "Fair Use/Derivative Work" ○ Microsampling ○ Application to specific situations ○ Debate: are these laws appropriate or too restrictive?	

		○ *Case study: Case study 19-21*	
10/31 (11)	4	***Copyright Laws and the Relationship between Music Technology and Society*** • **Music Downloading and Listening on the Internet** ○ Legal methods (current and past) ○ Illegal methods (current and past) ○ "Digital Rights Management" (DRM), influence on purchasing and listening habits ○ Debate: Why do people still choose to download music illegally? ○ Debate: How does DRM influence consumer purchasing habits? ○ *Case study: Case study 22-24*	Unit 4 paper due Friday 9pm Group C gives presentation on Thursday
11/17 (12)	5	***New Music Performance tools*** • **Creating new software instruments with computers (patches)** ○ Max/MSP (PD) ○ Real-time sampling programs ○ *Case study: Examples of Max patches* • **Creating new hardware instruments with computers (artificial controllers)** ○ Survey of existing controllers ○ Uses, comparison to original ○ Given our existing MI knowledge, what kinds of new controllers could we build? Does an artificial controller have to be modeled after a traditional acoustic instrument? ○ *Case study: Videos of artificial controllers*	
11/14 (13)	5	***New Music Performance tools*** • **Automated Accompaniment Systems** ○ Music Plus One ○ Score Following as a tool ○ *Case study: Music Plus One videos*	Unit 5 paper due Friday 9pm Group D gives presentation on Thursday
11/21		**No class—Thanksgiving Break**	
11/28 (14)	6	**Summary: What have we learned about Music Informatics?** • How does our previous music technology knowledge inter-relate with what we've learned in this class? • How can we solve big-picture issues that relate to music and technology? • What kinds of new Music Informatics issues have you considered during this course? • What tools could you use to solve them? • Do you have a new definition of Music Informatics?	
12/05 (15)	6	**Summary: What have we learned about Music Informatics?** • How does our previous music technology knowledge inter-relate with what we've learned in this class? • How can we solve big-picture issues that relate to music and technology? • What kinds of new Music Informatics issues have you considered during this course? • What tools could you use to solve them? • Do you have a new definition of Music Informatics?	
12/12		**No class—Finals week**	**Final Exam: 10am 12/14 MUS244**