

SOMPHONY: VISUALIZATION AND COMPARISON OF SYMPHONIES THROUGH APPLICATION OF TIME SERIES ON 3D SOM

A Thesis Proposal
Presented to
the Faculty of the College of Computer Studies
De La Salle University Manila

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Abstract

Symphonies are musical compositions for orchestras usually consisting of several large sections called movements. They are usually composed of three to five movements, depending on the time period and are constructed by many different composers (Libin, 2014). There are five major musical periods namely the Baroque period, Classical Period, 19th Century, Romantic Period, and the 20th Century. By visualizing and determining the relationship of one composition to another, this research will be able to show the visual representation of the styles of the different composers. Similarly, the research will also help identify the influence of composers on one another from one musical period to the next. The study of Azcarraga & Flores (2016) tried to understand their relationship using machine learning, which uses self-organizing maps (SOM) and K-Means to determine clusters, and used the frequency counts in order to determine the comparison, which resulted into a visually comparable image of trajectories. Using frequency count however does not take into account the sequence as well as transitions of music from one after the other. This research aims to use the concept of time series on the clustering of the self-organizing maps. By applying time series on the maps, more accurate results can be made.

Keywords: Machine Learning, Music, Time Series, Self-Organizing Map, K-Means Clustering.

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Chapter 1

Research Description

1.1 Overview of the Current State of Technology

Music has been a part of our culture for hundreds of years, classical music being one of the oldest genre of music. Classical music is rooted in the traditions of early western music and to this day, many people refer to classical music as serious music. Musicians, however, use classical music to refer to music composed during 1750 to 1825, otherwise known as the Classical Era (Bernstein, 1959). The central norms of classical music became established between 1550 and 1900, which is known as the common-practice period. The common-practice period contains a bulk of what we now know as classical music. Under this period there are 3 musical eras: Baroque, Classical and Romantic. Music from the Baroque period are decorated and elaborate, with little to no expression. Works from the Classical era contain repetitive dynamics and clean transitions. In contrast to music from the Baroque period, music from the Romantic period are expressive and emotive, having the ability to paint a vivid picture in the minds of the listeners (Grout, Palisca, 1996); however, Dahlhaus (1981) points out that another musical era existed between the Classical and the Romantic period and he refers to this as the 19th century era. This era serves as the transition period for classical and the romantic period, thus having similarities in style with both eras. After the common-practice period comes the 20th century era, which explores modernism, impressionism, neoclassicism and experimental music.

It was in the common-practice era when symphonies began to be composed. Libin (2014) describes symphonies as lengthy forms of musical compositions which are almost always written for orchestras and are consisting of several large movements. With a history of almost 300 years, symphonies today are viewed as

the very pinnacle of classical music where Beethoven, Brahms, Mozart and other renowned composers were able to find a venue for transcending their creativities and overall influencing them heavily on their music. During the course of the 18th century, the tradition was to write four-movement symphonies (Hepokoski & Darcy, 2006).

Throughout time, different styles have developed, each having features unique to themselves. Tilden (2013) notes the historical influence of composers with each other and how similar the methods of composing classical music are with pop music. Due to these facts presented, symphonies written in the early 20th century may be influenced by the great composers and compositions of the previous eras. Analyzing these musical relationships and comparing one to another is a research area that could be done through both manual and machine learning methods.

McFee, Barrington & Lanckriet (2012) compare the usage of context-based manual semantic annotation versus their proposed optimized content-based similarity learning framework. With machine learning, the usage of high-quality training data without active user participation and the analysis of more data is possible than with feedback or survey data from active user participation. Human error in the analysis process can also be minimized with machine learning since human-supervised training is minimal. Corra & Rodrigues (2016) shows the analysis of music features using machine learning techniques. According to the MIR community (Silla & Freitas, 2009), the two main representation of music feature content are either audio-recorded or symbolic-based. The former employs the explicit recording of audio files while the latter uses symbolic data files such as MIDI or KERN.

SOMphony, a research paper by Azcarraga & Flores (2016) aims to understand the relationship of compositions between the same composer to denote style as well as to determine if there are similarities between compositions of different periods of music to denote influence between time periods. The research showed the relationships and influences between composers from 5 major musical periods, namely the Baroque Period, Classical Period, 19th Century music, Romantic Period and the 20th century. The research focuses on self-organizing maps (SOM) that are trained using 1-second music segments extracted from the 45 different symphonies. The trained SOM is then further processed by doing a k-means clustering of the node vectors, allowing quantitative comparison music trajectories between symphonies. Their research showed that using self-organizing maps are indeed helpful in visualizing the musical features of a symphony, making it easier to create insights about the relationships within the different pieces and composers. The research concludes that a larger dataset would be needed to confirm whether the approach is indeed valid.

However, SOMphony does not take into consideration the notion of time. In time series data, each instance represents a different time step and the attributes give values associated with that time (Witten & Frank, 2005). To be able to generate time sensitive musical analysis, time series is to be added to the SOM and a new visualization in 3D space would need to be created.

1.2 Research Objectives

1.2.1 General Objective

To incorporate the use of time series in the visualization of symphonies for comparison of similarities

1.2.2 Specific Objectives

1. To include more musical pieces to the data set;
2. To perform feature selection to determine optimal features to be used;
3. To add in the time series variable;
4. To create a 3D visualization model for the data;
5. To have participants listen and annotate the musical pieces for qualitative data;
6. To verify the results of the 3D SOMphony through the results obtained from the human participants;

1.3 Scope and Limitations of the Research

To expand the data set of SOMphony, the proponents will add an additional 2 symphonies to the existing 3 symphonies for each composer. This will result to a total of 125 symphonies all in all. By having an equal number of symphonies per composer, this maintains a balanced data set for all composers. The criteria for choosing the symphonies to be added would be random to have a better grasp on the general style of the composer.

To be able to generate a self-organizing map, the proponents will use jAudio to extract 600 audio features from musical segments generated from the symphony. For the labelling phase, the proponents will classify the selected features by composition because the research focuses on comparing different compositions and comparing eras or composers. The 600 audio features would be trimmed down through feature selection. Decision trees would be used to determine the features to be kept since those nodes that are nearest to the root node of the tree would be dubbed as the more important features compared to the others. The proponents have decided to have 20 as an arbitrary value for the features to be used. By selecting only 20 features, the data set would have a uniform number of features for all symphonies and it would also enhance the efficiency of training the SOMs as it would not take a long time to extract 20 features compared to extracting 600.

In incorporating the time series, the musical piece is divided into 1 second segments in order to be uniform all throughout the piece and to avoid incomplete notes. A 0.5 second overlap is used to be able to consider transitions between each second.

To create a 3D model to represent the symphony, the proponents will assign each generated SOM to a point in time and will be used to create a graph representing each map in a time series. As a result of using time series, our research will be able to better differentiate symphonies that use similar themes but at different periods of time in the composition.

In gathering qualitative data from human participants, the proponents limit themselves to 50 participants. In the case that the target amount is not reached within two months, the researchers will proceed to analyze the results they have obtained. The participant profile would be people that have experience or familiarity with classical music. The participants would be presented with a 3D graph and two music players. They are tasked to annotate specific regions of the symphony if they are indeed similar. However we do not limit the participants to the specified regions, the participants are free to annotate parts that they believe sound similar.

Similar to SOMphony, the proponents will focus on representation of symphonies using SOMs for the purpose of comparison to other symphonies. Through the data obtained from the human participants, the proponents will be able to validate if the 3D visualization method is enough to represent the entirety of the symphony for comparison.

1.4 Significance of the Research

As Tilden (2013) states, the structure of classical and modern music are very similar, having the verse-chorus structure and modern pop songs are first composed instrumentally as similar with how classical music is composed. Modern music just takes classical music further by adding in voice and combining the different techniques employed by classical music. As this study focuses on comparing different symphonies and analyzing to see how similar they are, the results of this study will show us trends among composers in terms of their influence on one another in a musical era, the influence one composer had over other composers from a later era, and what the particular style of a composer would look like in the SOM. This research will show whether composers from back then had a lasting influence on music 100 or so years from a particular composers time period. This research can also show if a particular composer has a definite coherent style that is present in his musical pieces by comparing his works.

Some possible future application of the results of this study would include the improvement of existing music information retrieval (MIR) techniques used by music databases. Corra, D. C., & Rodrigues, F. A. (2016)s research shows a possible improvement on automatic music genre classification using symbolic-based music features. Similarly, this research can also be used to further improve the algorithms used by playlist managers for the retrieval of similar songs from music databases using the comparison of the trained SOMs.

The application of time series in machine learning would benefit studies outside of music that incorporates the use of time sensitive data. It can be used in future works regarding traffic modelling, weather monitoring, prediction, and other time sensitive fields.

Chapter 2

Review of Related Literature

This chapter discusses the features, capabilities, and limitations of existing research, algorithms, or software that are related or are similar to the thesis.

2.1 Musical Data Representation and Interpretation

Musical Data Representation and Interpretation			
Authors & Year	Title	Research Problem	Approach
Correa, D. C., & Rodrigues, F. A. (2016)	A survey on symbolic data-based music genre classification	Expanding music database needs more accurate tools for music information retrieval	Symbolic-based music feature are used to train system for genre classification.
Dubnov, et. al. (2003)	Using Machine-Learning Methods for Musical Style Modeling	Predicting and determining musical context based on relevant past sample is very difficult because the length of the musical context varies widely	Two approaches, incremental parsing (IP) and the prefix suffix trees (PST), are used in designing predictors that can handle data with very large length.
Cambouropoulos, E. & Widmer, G. (2000)	Automated Motivic Analysis via Melodic Clustering	Finding similarity in music patterns.	Their method uses differences in pitch-intervals and rhythm as basis for splitting one musical motive (small bits of music) from another.

According to Corra, D. C., & Rodrigues, F. A. (2016), as music grows continuously over time, a constant need for an upgrade to satisfy the number and size of music databases causes the development of more accurate tools for music information retrieval (MIR) . MIR is the research field responsible for the development of algorithms or other computational means for the retrieval of useful information from music and the classification of music based on their categories. The ever increasing research on machine learning, the ever expanding abundance of digital audio formats, the growing quality and availability of online symbolic music data, and availability of tools for extracting musical properties motivate this study on

machine learning and MIR. One of the main problems in MIR involves the classification of music based on their genre which this study tackles. The automatic genre classification of music plays a key role in online music databases where websites or device music engines manage and label music content for retrieval.

Symbolic-based data are music features extracted from symbolic data formats such as MIDI and KERN. In the MIR community, two main representations of music content for MIR research are followed, either the audio-recorded or the symbolic content. Audio-recorded content produce low-level and middle-level features, whereas symbolic content produce high-level features. When analyzing music content, it is preferable to extract more features with the high-level feature of the symbolic content since it is closer to the human perception of music. Due to these reasons, symbolic-based content is used for the research. This research further provides overviews of important approaches regarding music genre classification with the use of symbolic-based music features. The research, as a result, reveals that pitch and rhythm are the best musical aspects to be explored in symbol-based music feature classification that lead to accurate results. Some limitations for further improvement on future works however are present such as the small amount of music dataset used in the research, the bias of using western culture music, and the lack of comparison means for the result of the research due to the lack of previous research works regarding symbolic-based music genre classification.

Dubnov, et. al. (2003) formulated that by using statistical and information theoretic tools, one can capture some of the more fundamental trends in musical scores for further analysis. By applying machine learning on these statistical data, one can derive mathematical models for inferring and predicting to a certain extent of generating a seemingly new work based on the classical pieces of some popular composers.

Their main source of data for extracting musical surface, a collection of notes for the musical piece, comes in the form of MIDI files or musical instruments digital interface. Machine learnings primary purpose in this study is to help gather the appropriate data to perform statistical analysis for the usage of applications such as style characterization tools for the musicologist, generation of stylistic metadata for intelligent retrieval in musical databases, music generation for web and game applications, machine improvisation with or without interaction with humans, and computer-assisted composition.

Predicting and determining musical context based on relevant past sample is very difficult because the length of the musical context varies widely. Large contexts make it very difficult to estimate because the number of parameters, computational costs, and data requirements for reliable estimation increases exponentially. To address this problem, the usage of predictors that can handle

data with very large length is necessary. Two approaches are used to design such a predictor, namely the incremental parsing (IP) and the prefix suffix trees (PST).

The IP algorithm is a lossless coding scheme implying that the application of this algorithm doesn't result to loss of some spectrum of music while the PST is a lossy compression. The IP also makes sure that every transition is included in the parsing of the music while in PST, the method is very selective in that some rare events and events that do not improve transition are not included. IP uses online estimation through instantaneous coding meaning that IP continually searches online on possible ways or methods to estimate or predict the next possible sequence while in PST, analysis is done by batches through file compression. By analyzing the statistical data provided by either algorithm, predictions or estimates for the next sequence can be made.

Cambouropoulos, E. & Widmer, G. (2000) stated that music could be categorized into small bits called "motives". These motives are extracted from a musical piece by determining which clusters of musical data can be grouped together while maintaining melodic and rhythmic coherence. This is achieved by representing a melodic segment as a series of notes while minding musical closeness.

Their paper outlines a method that uses differences in pitch-intervals and rhythm as basis for splitting one musical motive from another. For example, two segments can be considered similar if they share a certain number of component notes or intervals using approximate pattern matching. The segments can also be considered similar if they contain shared elements at different pitches. However, this would require a more advanced pattern matching and data structure.

2.2 Music Visualization

Musical Visualization			
Authors & Year	Title	Research Problem	Approach
Azcarraga & Flores (2016)	SOMphony: Visualizing Symphonies Using Self-Organizing Maps	How influential are composers and their symphonies back in the early musical eras?	Construct 2D SOM trained using k-means clustering to construct visual maps for comparison of symphonies.
Azcarraga, A., Caronongan, A., Setiono, R., & Manalili, S. (2016)	Validating the Stable Clustering of Songs in a Structured 3D SOM	Will constructing the classic 2D SOM as a 3D map be feasible, with the learning algorithm still the same as the 2D map?	The 3D map is designed as a $3 \times 3 \times 3$ cube with $9 \times 9 \times 9$ nodes. The cube is divided into one core cube and 8 corner cubes. The Euclidean distance from core to each corner represents the quality of the different categories or genres.
Foote (1997)	Visualizing music and audio using self-similarity	Is it possible to display the acoustic similarity between any two instants of an audio file as a two-dimensional representation	Audio similarity is computed by parameterizing them into MFCCs and getting the autocorrelation of two MFCC feature vectors V_i and V_j that were derived from audio windows.

Azcarraga & Flores (2016) made a paper about Visualizing Symphonies using Self Organizing Maps in order to know whether the music of a certain composer and certain century is influenced by their past counterparts. In the map, there are different parts of it that represents a unique sound. Every time a specific pitch is hit by the music, a line is drawn until the music of a certain composer is finished. The study used traditional machine learning algorithm in order to know whether there is similarity across each century composers. Basically, the study counts the frequency of a certain pitch sound and summarizes it in order to compare it with other composers.

In order to make a deeper analysis of the study. A new algorithm and variable is going to be used. In the study of this thesis paper, the researchers will add a new dimension and the new variable is a time. The time where a specific pitch will now be important in comparing it to the other pitches of the composers. With this, Time Lapse Algorithm is going to be used in order to summarize data with the time included.

Azcarraga, A., Caronongan, A., Setiono, R., & Manalili, S. (2016) presents a variant of the classical 2D SOM that is stable with the general clusters not moving around on every training phase. A structured 3D SOM is an extension of a 2D Self-Organizing Map to 3D with a predefined structure. In their research, the 3D map is represented as a 3x3x3 cube with 27 sub-cubes of the same size. Each sub-cube is further divided into 9x9x9 nodes. The structured 3D SOM is a collection of one distinct core cube in the center and 26 exterior cubes surrounding it, hence summing to a total of 27 sub-cubes. Alongside 3D SOMs built in structure, the learning algorithm used in this 3D SOM includes a four-phase learning and labelling phase. The first phase of training involves the semi-supervised training of the core cube. The second phase involves yet another semi-supervised training, but for the eight corner cubes. The third phase involves training the core cube again, but the training will be unsupervised. The fourth and final phase will be the labelling phase. This phase involves the uploading of the music files into the cube and labelling them accordingly. The music dataset used in this research includes songs from 9 genres: blues, country, hip-hop, disco, jazz, metal, pop, reggae, and rock. Each genre has 100 songs, thus summing to a total of 900 songs.

SOM is usually represented as a 2D map with the input elements being similar to the input environment. This research verifies that designing the SOM as a 3D map is very feasible, with the learning algorithm still the same as with the 2D map. By extending the SOM from 2D map to 3D, the map is further distinguished into the sub-cubes: eight corner cubes and one core cube in the center. Each corner cube represents a music genre while the core cube represents the song itself. The 3D SOM will be able to identify the quality of the different categories or genres of music albums based on a measure of distortion values of music files with respect

to their respective music genres. Distortion value is measured by the Euclidean distance between the core cube and a corner cube.

Foote (1997) presented a paper on Visualizing Music and Audio using Self-Similarity. In this paper, the acoustic similarity between any two instants of an audio file is calculated and displayed as a two-dimensional representation. Structure and repetition is a general feature of nearly all music, with parts resembling certain parts of the song that came before it. This paper presents a method of visualizing the structure of the music by its acoustic similarity or dissimilarity in specific instances of time through grayscale gradation patterns.

Before getting the similarity measures, the two instants are first parameterized into Mel-frequency cepstral coefficients (MFCCs) plus an energy term. The similarity measure $S(i, j)$ is computed by getting the autocorrelation of two MFCC feature vectors V_i and V_j that were derived from audio windows. A simple metric of vector similarity S is the scalar product of the vectors. A better similarity measure can be obtained by computing the vector correlation over a window w . This captures the time dependence of the vectors. To have high similarity measure, the vectors must not only be similar, but their sequence must be similar as well.

Given the similarity measures $S(i, j)$ computed for all window combinations, an image is constructed so that each pixel at location (i, j) is given a grayscale value proportional to the measure. The maximum similarity measure is given maximum brightness. Visually, regions of silence or long sustained notes appear as bright squares on the diagonal. Repeated figures such as choruses and phrases will appear as bright off-diagonal rectangles. If the music has a high degree of repetition, it will show up as diagonal stripes or checkerboards that are offset from the main diagonal. Longer audio files would result to larger images due to the rapid rate of feature vectors. To reduce the image size, the similarity is only calculated for certain time indexes and since S is already calculated at window size w , the paper only looks at time indexes that are an integer multiple of w .

Chapter 3

Research Methodology

This chapter contains phases and activities that will be performed to accomplish the research. The phases listed here will be arranged sequentially unless otherwise stated.

3.1 Research Activities

3.1.1 Concept Formulation and Review of Related Literature

This phase will concern the consolidation of the thesis requirements such as the objective of the research, the research problem to be tackled, and the scopes and limitations of such research. Literatures related to 2D and 3D self-organizing maps, music feature classifications, k-means clustering, and machine learning will be part of the Review of Related Literature.

3.1.2 Data Gathering

This phase will concern the gathering of the additional symphonies to be used for the research to provide more reliable results. Aside from the music dataset used in SOMphony, 2 symphonies will be added to each composer, summing up to a total of 5 symphonies per composer and 125 in all. The proponents have decided to maintain 5 symphonies per composer so that the data set will be balanced.

The process of selecting which symphonies to be added would be by random to have a better grasp of the general style of the composer. The audio files would be retrieved from online sources. The researchers would not take into consideration the file type and bitrate of the audio files since music data that is free for use is limited.

3.1.3 Pre-processing

To start pre-processing, the audio files would be converted into wav files in preparation for splitting. WaveSplitter will be used in splitting the audio file into 1 second segments at intervals of 0.5 second. These segments would undergo feature extraction using jAudio. The result would be an xml file containing all the features determined for each segment. The researchers would then run RegEx to extract the unnecessary text in preparation for labeling. Since the proponents would have supervised learning, the data needs to be labelled according to their composer, composition and file name.

3.1.4 Feature Selection

In this phase, the proponents will trim down the 600 features that jAudio has extracted. Using decision trees, the top 20 nodes will be selected as the top 20 features. The proponents have decided to have 20 as an arbitrary value for the features to be used. By doing feature selection, the data set would have a uniform number of features for all symphonies and it would also enhance the efficiency of training the SOM. The tree model produced after feature selection is what would be used in training the SOM.

3.1.5 Visualization

In this phase, the proponents will trim down the 600 features that jAudio has extracted. Using decision trees, the top 20 nodes will be selected as the top 20 features. The proponents have decided to have 20 as an arbitrary value for the features to be used. By doing feature selection, the data set would have a uniform number of features for all symphonies and it would also enhance the efficiency of training the SOM. The tree model produced after feature selection is what would be used in training the SOM.

3.1.6 Performance Evaluation and Human Evaluation

In this phase, the proponents limit themselves to 50 participants. The participant profile would be people that have experience with classical music. In the case that the target amount is not reached within two months, the researchers will proceed to analyze the results they have. The participants would be presented with a 3D graph and two music players. They are tasked to annotate specific regions of the symphony and verify if they are indeed similar. However we do not limit the participants to the specified regions, the participants are free to annotate parts that they believe sound similar.

3.1.7 Documentation

This phase will be done all throughout the whole research timeframe. This will include taking down notes on observations and findings during experiments and during the review of related literature, writing related technical documents, and the research paper itself.

3.1.8 Calendar of Activities

Table 3.1 shows the time table for the activities involved with the research. The numbers represent the number of weeks worth of activity. The # symbol represents the number of weeks allotted for the month.

Calendar of Activities							
Activities for 2017	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Concept Formulation and RRL	###	###	#				
Data Gathering			#	###	##		
Pre-processing				##	##	####	##
Feature Selecion						##	##
Visualization Development				##	##	##	#
Performance and Human Evaluation							
Documentation	##	###	##	###	####	####	##

Calendar of Activities							
Activities for 2018	Jan	Feb	Mar	Apr	May	Jun	Jul
Concept Formulation and RRL							
Data Gathering							
Pre-processing							
Feature Selecion						###	
Visualization Development				###	####		
Performance and Human Evaluation			####	####	###	###	
Documentation	###	####	####	####	####	####	##

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Chapter 4

Appendix A

Research Ethics Documents

This appendix contains all documents related to research ethics.

DE LA SALLE UNIVERSITY
General Research Ethics Checklist

This checklist is to ensure that the research conducted by the faculty members and students of De La Salle University is carried out according to the guiding principles outlined in the Code of Research Ethics of the University. The investigator is advised to refer to the De La Salle University Code of Research Ethics and Guide to Responsible Conduct of Research before completing this checklist. Statements pertinent to ethical issues in research should be addressed below. The checklist will help the researchers and evaluators determine whether procedures should be undertaken during the course of the research to maintain ethical standards. The University's Guide to the Responsible Conduct of Research provides details on these appropriate procedures.

Details of the Research	
Students	Cruz, Eduardo Dionisio, Jefferson Fukouka, Kenji Portales, Naomi
Thesis Adviser	Flores, Fritz
Department	Software Technology Department
Title of the Research	SOMphony: Visualization and Comparison of Symphonies Through Application of Time Series on 3D SOM
Term(s) and Academic year in which research is to be conducted	AY 2017-2018 Term 1,2,3

This checklist must be completed AFTER the De La Salle University Code of Ethics has been read and BEFORE gathering data.

Questions	Yes	No
1. Does your research involve human participants (this includes new data gathered or using pre-existing data)? If your answer is yes , please answer Checklist A (Human Participants) .	✓	
2. Does your research involve animals (non-human subjects)? If your answer is yes , please answer Checklist B (Animal Subjects) .		✓
3. Does your research involve Wildlife? If your answer is yes , please answer Checklist C (Wildlife) .		✓
4. Does your research involve microorganisms that are infectious, disease causing or harmful to health? If your answer is yes , please answer Checklist D (Infectious Agents) .		✓

5. Does your research involve toxic/chemicals/ substances/materials? If your answer is yes , please answer Checklist E (Toxic Agents) .		✓
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Research with Ethical Issues to address:

If you have a YES answer to any of the above categories, you will be required to complete a detailed checklist for that particular category. A YES answer does not mean the disapproval of your research proposal. By providing you with a more detailed checklist, we ensure that the ethical concerns are identified so these can be addressed in adherence to the University Code of Ethics.

Declaration of Conflict of Interest

☒ I do not have a conflict of interest in any form (personal, financial, proprietary, or professional) with the sponsor/grant-giving organization, the study, the co-investigators/personnel, or the site.

☐ I have a personal/family or professional interest in the results of the study (family members who are co-proponents or personnel in the study, membership in relevant professional associations/organizations).

Please describe the personal/family or professional interest:

☐ I have propriety interest vested in this proposal (with the intent to apply for a patent, trademark, copyright, or license)

Please describe propriety interest:

☐ I have significant financial interest vested in this proposal (remuneration that exceeds P250,000.00 each year or equity interest in the form of stock, stock options or other ownership interests).

Please describe financial interest:

Declaration

We certify that we have read and understand the De La Salle University Code for the Responsible Conduct of Research and will abide by the ethical principles in this document. We will submit a final report of the proposed study to the DLSU-Research Ethics Office. We will not commence with data collection until we receive an ethics review approval from the College Research Ethics Committee.

Name and Signature of Student 1

Name and Signature of Student 2

Name and Signature of Student 3

Name and Signature of Student 4

Endorsement from thesis adviser to the thesis panel for proposal defense...

Name and Signature of Adviser

Date

Endorsement from thesis adviser to the thesis panel for final defense...

This is to certify that the research was conducted in a manner that adheres to ethical research standards. I am thus endorsing the group for final defense.

Name and Signature of Adviser

Date

 De La Salle University	<h2>Research Ethics Review Committee</h2> <p>Research Ethics Office, 3F Henry Sy Sr. Hall De La Salle University Manila 2401 Taft Avenue, Manila 1004, Philippines REO@dlsu.edu.ph (632) 524-4611 loc. 513</p>	SOP No.: 2
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DE LA SALLE UNIVERSITY
Checklist A
Research Ethics Checklist for Investigations involving Human Participants

This checklist must be completed AFTER the De La Salle University Code of Research Ethics and Guide to Responsible Conduct of Research has been read and BEFORE gathering data. The University Code of Research Ethics is available at http://www.dlsu.edu.ph/offices/urco/forms/URCO-Code-of-Research-Ethics_August2011.pdf

NOTE: This checklist is completed after the research proponent fills out the General Checklist Form.

Only answer this Checklist if you answered YES on question 1 of the General Checklist.

Researcher Details	
Students	Cruz, Edwardo Dionisio, Jefferson Fukuoka, Kenji Portales, Naomi
Thesis Adviser	Flores, Fritz
Department	Software Technology Department
Title of the Research	SOMphony: Visualization and Comparison of Symphonies Through Application of Time Series on 3D SOM
Term(s) and Academic year in which research is to be conducted	AY 2017-2018 Term 1,2,3

Provide a brief description of the data collection procedure to be undertaken in the research:

Human participants will be tasked to listen to small music samples to be used for comparison in the research. They can also opt to annotate the parts they listen to for additional comments.

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The following should be attached to the checklist:

- A copy of the informed consent form to be used in the study.
- A copy of the instrument/tool that will be administered to the participants.
- If applicable, a copy of the letter seeking permission to collect data from participants who are under the supervision of an agency, institution, department, or office.
- If applicable, a copy of the parental consent form for participants below 18 years old.

The following items refer to important ethical considerations in the conduct of research with human participants. Provide a check for the appropriate answer to each question.

Source of data

Please check all that apply:

	1. New data will be collected from human participants	
	If you checked this item, how will the new data be gathered? Please check all that apply.	
	After answering this question, please proceed to page 3	
		Experimental Procedures/Intervention/ Treatments
		Focus Group
	✓	Personal Interviews
	✓	Self-administered Questionnaire
	✓	Researcher-administered Questionnaire
	✓	Internet survey
	Observation	
	Telephone survey	
	Others, please specify:	
	2. Pre-existing data from human participants, i.e., from a dataset	
	If you checked this item, please proceed to page 7	

If both options are checked (both new data and pre-existing data), answer all of the questions in this document.

ONLY ANSWER IF NEW DATA WILL BE COLLECTED (item 1 above)

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Sampling Details	
Number of Participants/Subjects	50
Location where the participants will be recruited/ where subjects will be obtained?	Online, university sites, music associations
How long will the data collection take place?	2 months
Who will perform the data collection?	any of the researchers when on-site survey, self-administered
Location(s) where data collection will take place	Online, university sites, music associations
What procedures will be employed to ensure voluntary consent from participants?	for on-site surveys, person to be surveyed shall be notified first through email, phone call, or other communication means
Data Retention	
How long will data with participant identifiers be kept after the publication of the first paper from the project?	There will be no personal identifiers of participants since they shall remain anonymous.
How long will anonymized data be kept after the publication of the first paper from the project?	Anonymized data shall be kept in archive for future works.
Procedure for Informed Consent	
How will informed consent be recorded? (check all that applies) Reminder: please attach informed consent that will be used in the study	<input checked="" type="checkbox"/> Written Consent <input type="checkbox"/> Audio-recorded Consent <input checked="" type="checkbox"/> Online/Email recorded Consent <input type="checkbox"/> Others, please specify:

If you will not obtain a recorded informed consent, answer the questions that follow:

Why does the waiver of informed consent not pose a threat to the welfare and rights of the participants?

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Why is recording an informed consent not practical for the proposed study?

	Yes	No	Not Applicable
1. Will the research involve students who will be receiving course credits for their participation? If YES, please attach a copy of the consent form and a summary of the debriefing process that will help participants understand how their participation in the research has provided a relevant learning experience to the crediting course.		✓	
2. Does the study involve participants below 18 years old or those who are unable to give their informed consent? If YES, please attach a copy of the parental consent form.		✓	
3. Is there a possibility that the research can induce physical and/or psychological harm to the participants? Will they experience pain or some discomfort as a result from their participation in the research? If YES, please attach an acceptable argument that outlines the benefits of doing the research and how they outweigh the cost of harming the participants.		✓	
4. Will the participants be deliberately falsely informed or made unaware that they are being observed? Will they be misled in a way that they will possibly object to or show unease when told of the real purpose of the study?		✓	

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<p>If YES, please attach an acceptable argument that outlines the benefits of doing the research and how they outweigh the cost of harming the participants.</p>			
<p>5. Will the research involve the discussion of, or questions on, sensitive topics (e.g. sexual activity, substance abuse, or mental health)?</p> <p>If YES, please make sure that the informed consent form explicitly states that sensitive questions will be posed and that you will safeguard the anonymity of the participants and ensure confidentiality. Please attach a copy of your informed consent form and your instrument.</p>		✓	
<p>6. Will the research involve the administration of drugs, or other substances to the participants?</p> <p>If YES, please attach an acceptable argument that outlines the benefits of doing the research and how they outweigh the cost of harming the participants.</p> <p>Please also attach a description of the procedure that will ensure that the participants will be brought back to their physical and psychological states prior to their participation in the research.</p>		✓	
<p>7. Will biological samples (e.g. blood, saliva, urine) be obtained from the participants?</p> <p>If YES, will this involve invasive procedures? Please attach a description of these procedures.</p>		✓	
<p>8. Will genetic materials be obtained from the biological samples?</p>		✓	

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If YES, please attach a description of the procedures that will ensure confidentiality. Please attach the informed consent form.			
9. Will financial inducements (other than reasonable expenses, like transportation or meal allowances) be offered to the participants for their participation in their research? If YES, the researcher(s) should be mindful of how the inducements can influence the participants' responses or behaviors during the research. Indicate the financial inducements offered to the participants: _____		✓	
10. Is there a possibility for groups or communities to be harmed by the dissemination of the research findings? If YES, please attach a description of procedures to ensure the anonymity and confidentiality of the research findings.		✓	

*Answering **YES** to most of the above items will signal an ethical issue that needs to be addressed. Some actions that will allow adherence to research ethical principles are provided with each item. The researcher is advised to refer to the University's Guide to the Responsible Conduct of Research for the appropriate procedures to ensure adherence to ethical principles in the conduct of research.*

Declaration

We certify that we have read and understand the De La Salle University Code for the Responsible Conduct of Research and will abide by the ethical principles in this document. We will submit a final report of the proposed study to the DLSU-Research Ethics Office. We will not commence with data collection until we receive an ethics review approval from the College Research Ethics Committee.

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Name and Signature of Student 1	Name and Signature of Student 2
Name and Signature of Student 3	Name and Signature of Student 4

Endorsement from thesis adviser to the thesis panel for proposal defense...	
Name and Signature of Adviser	Date

Endorsement from thesis adviser to the thesis panel for final defense...	
This is to certify that the research was conducted in a manner that adheres to ethical research standards. I am thus endorsing the group for final defense.	
Name and Signature of Adviser	Date

FOR PROPONENTS WHO WILL GATHER NEW DATA ONLY, PLEASE STOP ANSWERING.

Use of Pre-existing Data collected from Human Participants		
Indicate the dataset from which the data for the study will be sourced		
		Yes Please indicate where the dataset is available:

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Is the data publicly available, i.e., the access to which does not necessitate an approval process?		No Please indicate/attach the approval authority for access:
Was the original dataset originally collected for the present study's purpose?		Yes Please attach the Consent Form used in the original study.
		No Please attach the Information Collection Statement (i.e., the statement given to informants providing them with the rationale for the collection of specific information).
Does the original data set contain sensitive data, that is information that an individual would not likely want to be disclosed publicly, e.g., data on sexual activities, substance use?		Yes Please describe the type of sensitive data to be used in the present research:
		No
Does the original dataset have personal identifiers?		No (This means that neither the researcher nor the participant provided any personal identifiers)
		Yes, specifically: _____ Direct (i.e., the participant provided personal details like name and address) _____ Indirect (i.e., the participant was given a respondent code to make the participant identifiable)
Will new data be collected and analyzed along with data from the existing dataset?		Yes Please answer questions on page 3-5.
		No

Declaration

We certify that we have read and understand the De La Salle University Code for the Responsible Conduct of Research and will abide by the ethical principles in this document. We will submit a final

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report of the proposed study to the DLSU-Research Ethics Office. We will not commence with data collection until we receive an ethics review approval from the College Research Ethics Committee.

<p>_____ Name and Signature of Student 1</p>	<p>_____ Name and Signature of Student 2</p>
<p>_____ Name and Signature of Student 3</p>	<p>_____ Name and Signature of Student 4</p>

Endorsement from thesis adviser to the thesis panel for proposal defense...	
<p>_____ Name and Signature of Adviser</p>	<p>_____ Date</p>

Endorsement from thesis adviser to the thesis panel for final defense...	
<p>This is to certify that the research was conducted in a manner that adheres to ethical research standards. I am thus endorsing the group for final defense.</p>	
<p>_____ Name and Signature of Adviser</p>	<p>_____ Date</p>

Thesis Informed Consent Form

Good day participant! We are undergraduate students in De La Salle University-Manila currently taking up our thesis as per required by the curriculum of BS Computer Science with specialization in Software Technology. Our research is about visualizing symphonies using 3D Self-Organizing Maps and comparing their visual results. In this survey, we will be providing you with parts of two symphonies that are deemed by our software as very similar. The purpose is to affirm that the visualizations and comparisons made by our software coincide with how humans determine similarity among symphonies. The survey shall only take up about 10-20 minutes of your time. Participation is voluntary and without incentive. Withdrawal from participation will not merit any sanctions or consequences. No sensitive information will be asked except for the name which will be kept absolutely confidential and only the researchers will have access to the name provided. Lastly, you must be 18 years old or above to participate in this survey. If you have any concerns and clarifications, please contact us at jefferson_dionisio@dlsu.edu.ph

RESEARCH ETHICS CLEARANCE FORM For Thesis Proposals ¹	
Names of student researcher/s :	<i>Cruz, Edwardo Dionisio, Jefferson Fukuoka, Kenji Portales, Naomi</i>
College:	College of Computer Studies
Department:	Software Technology Department
Course:	BS Computer Science with specialization in Software Technology
Expected duration of project:	from: September 2017 to: July 2018
Ethical considerations <i><list down the ethical concerns as listed in your defense form; also include steps made to resolve them></i> <i>Human participants who will compare data for validation of research findings:</i> <ol style="list-style-type: none"> <i>1. Consent forms shall be processed first before any data will be gathered from the participants.</i> <i>2. Human participants shall only be above 18 years old.</i> <i>3. On-site participants shall be informed at least a week before data collection.</i> <i>4. Participants can back out at any time during the course of the data gathering session.</i> 	
To the best of our knowledge, the ethical issues listed above have been addressed in the research. <div style="text-align: center;"> <i><name of adviser></i> <hr/> Name and signature of adviser/mentor Date: </div> <div style="display: flex; justify-content: space-between; margin-top: 40px;"> <div style="text-align: center;"> <i><name of panelist 1></i> <hr/> Name and signature of panelist Date: </div> <div style="text-align: center;"> <i><name of panelist 2></i> <hr/> Name and signature of panelist Date: </div> </div>	

¹The same form can be used for the reports of completed projects. The appropriate heading need only be used.