# Neural Network for composing music

**REQUEST FOR PROPOSAL**

***Musical Neural Network***

***03/20/2018***

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# 1. Executive Summary

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| a. | Describe the proposed system you wish to undertake. Is it a new site?  **Using TensorFlow we will be creating a neural network that can analyze and produce music.** |
| b. | What problems will this technology project solve or what new capabilities will it provide for your organization?  **It will open doors for any musician looking for unique musical inspiration.** |
| c. | If you have made a decision beforehand, indicate whether this site relies on a database to display information or will be "static" HTML.  We will be mostly working with Python as Tensorflow is written in it. |
| d. | Include a brief summary of the environment in which the hardware / software / services will operate.  **We will create a Github repository for easy access and easy workload management.**  **No special hardware is required.**  **Software – Tensorflow and other deep learning libraries.** |

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# 2. Proposed Timeline

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| Deliverable | START DATE | DURATION |
| Proposals due. | 2018-03-21 | - |
| Release and distribution of RFP. | 2018-03-22 | - |
| Initial meetings. | Once per week on Tuesday | 1 hour |
| Sponsor selected. | 2018-03-22 | - |
| Deadline for sponsor to submit written questions and/or non-mandatory notice of intent. | 2018-04-16 | 6 weeks |
| Questions with written answers provided to sponsor. | 2018-04-30 | 2 weeks |
| Analyze requirements | 2018-05-01 |  |
| Development methodology chosen | 2018-05-01 |  |
| Development milestones Design architecture, frontend, backend | 2018-05-01 |  |
| Build app | 2018-07-01 |  |
| Testing. | 2018-07-02 | 3 weeks |
| Final testing and debugging | 2018-10-01 |  |
| Finished due date | 2018-11-01 |  |

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# 3. Project Purpose and Description

The purpose of the proposed system is to create a neural network that we can train to recognize/analyze sheet music – Looking at the types of notes used in what way and the pauses between notes. The neuralnet can then generate its own unique music. Will it be capable of producing music indistinguishable from a human composer?

# 4. Project Scope

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| 4. Project Scope |
| |  | | --- | | Included  * Project plan * Test plan * Source code * Requirements * Specification files * Documentation * Change Documents * System Design  Excluded  * Hardware will not be included * End user training documents | |

5. Background of Proposed System

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| • Bob Sturm uses a character-based model with an LSTM to generate a textual representation of a song (in abc notation). The network seems to only be able to play one note at a time, but achieves interesting temporal patterns.  • Doug Eck, in A First Look at Music Composition using LSTM Recurrent Neural Networks, uses LSTMs to do blues improvisation. The sequences chosen all have the same set of chords, and the network has a single output node for each note, outputting the probability of that note being played at each time step. Results are promising in that it learns temporal structure, but is pretty restricted as to what it can output. Also, there is no distinction between playing a note and holding it, so the network cannot rearticulate held notes.  • Nicolas Boulanger-Lewandowski, in Modelling Temporal Dependencies in High-Dimensional Sequences: Application to Polyphonic Music Generation and Transcription, uses a network with two parts. There is an RNN to handle time dependency, which produces a set of outputs that are then used as the parameters for a restricted Boltzmann machine, which in turn models the conditional distribution of which notes should be played with which other notes. This model actually produces quite nice-sounding music, but does not seem to have a real sense of time, and only plays a couple of chords. |

6. Audience

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| The target audience is musicians/composers. |

# 7. Tools and Functionalities

## Tools

### Programming language

**Python:**

* Python is one of the most widely used programming languages in the AI field of Artificial Intelligence thanks to its simplicity.
* It can seamlessly be used with the data structures and other frequently used AI algorithms
* The choice of Python for AI projects also stems from the fact that there are plenty of useful libraries that can be used in AI.
* You will also have no problems learning Python for AI as there are tons of resources available online.

### Deep learning libraries

**Tensorflow:**

* When it comes to neural machine translation, TensorFlow reduces errors by 55%-85%.
* In Neural architecture search, one can figure out what is the right neural network to use for a problem
* TensorFlow allows coders to iterate quickly, train models faster and run more experiments
* On the production end— teams can run TensorFlow on large-scale server farms embedded on devices, CPUs, GPUs, TPUs

### Development platform

**GitHub:**

* By using GitHub, you make it easier to get excellent documentation. Their help section and guides have articles for nearly any topic related to git that you can think of.
* GitHub can integrate with common platforms such as Amazon and Google Cloud, services such as Code Climate to track your feedback, and can highlight syntax in over 200 different programming languages,
* GitHub is a repository. What this means that it allows your work to get out there in front of the public.

## 

## Functionality

* The functionality of this application is to generate music.
* Help musicians in the bleus genre to compose and generate music.
* To generate all types of genres in music.

8. Reporting Needs

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| System is not database driven so not database specific reports are required. Although .medi files will be used and will have to be stored in some sort of repository. The files will be analyzed and evaluated and reports will be generated accordingly showing the client all the different types of music files used and genres. The reports will then be reported back to the front end of the program and will show it as a graph of some sort, either in a pie or line chart. |

# 9. Proposed System Specification

The system specification that are required is knowledge about Python as it will be the main programming language that we are going to be using as well as a deep understanding and know how about neural networks and deep learning from the python libraries such as skitkat and tensorflow. Other knowledge will have to include a broad understanding of basic but also some advanced statistical know how. The report output will be given through the use of the mathplot lib that is available free to the public. The .midi files will be read in to the neural net one at a time until the neural net has learned how to write its own music based on what it had received as input. We also might have to buy or rent software that will allow us to play the music created by the neural net back to the client as feedback on what it had achieved.

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# 10. Available technology resources/integration issuers

There are plenty of free open-source deep learning libraries available on GitHub repositories and the one we are going to be using is Tensorflow as this was created by the google Brain Team for their own personal use. It was also used in the deepdream projects and is widely used in many high end companies such as SAP and Amazon to predict client behavior. The python libraries that we will be using such as the mathplot and skitkat libraries are also opensource and free to use. There is however cost involved in learning how to use these libraries and technology effectively, which is where the udemy course cost comes in down below.

# 11. Budget & Cost estimates

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| Budget summary: Seeing as we can fully create this project on a deep learning library – Open source and free. Our only costs will be acquiring the needed skills to finish this project.  Udemy has many courses in Python – The main language used by deep learning libraries.  I and my team have purchased a few to help us in development.  Receipts available on request. |
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| **Cost Item** | **QTY** | **Unit Cost** | **Total Cost** | **Maintenance first Years** | **Maintenance 5 years** | **Maintenance in %** |
| Udemy course | 5 | 120 | 600 |  |  |  |
|  |  |  |  |  |  |  |
| **TOTAL COST** |  |  | 480 |  |  |  |

# 12. Proposal Evaluation Criteria/ Format for proposals

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| 1. Technical Volume  Development will start on tensorflow – an opensource deep learning library created by google. All data relating to the project will be stored on github and managed via a source control app. We might need software to play our .midi file outputs but we can make a plan. |
| 3. Management Volume   1. Organizational structure:   Project leader: Nicolas  Developers: Ernes Smit, Marius Liebenberg, Drikus Mostert, Joe Munian, Mkhize Mbalenhle |
| 4. Budget Volume  Our only cost will be Udemy courses to give our developers the necessary info and skills required to complete this project. |
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