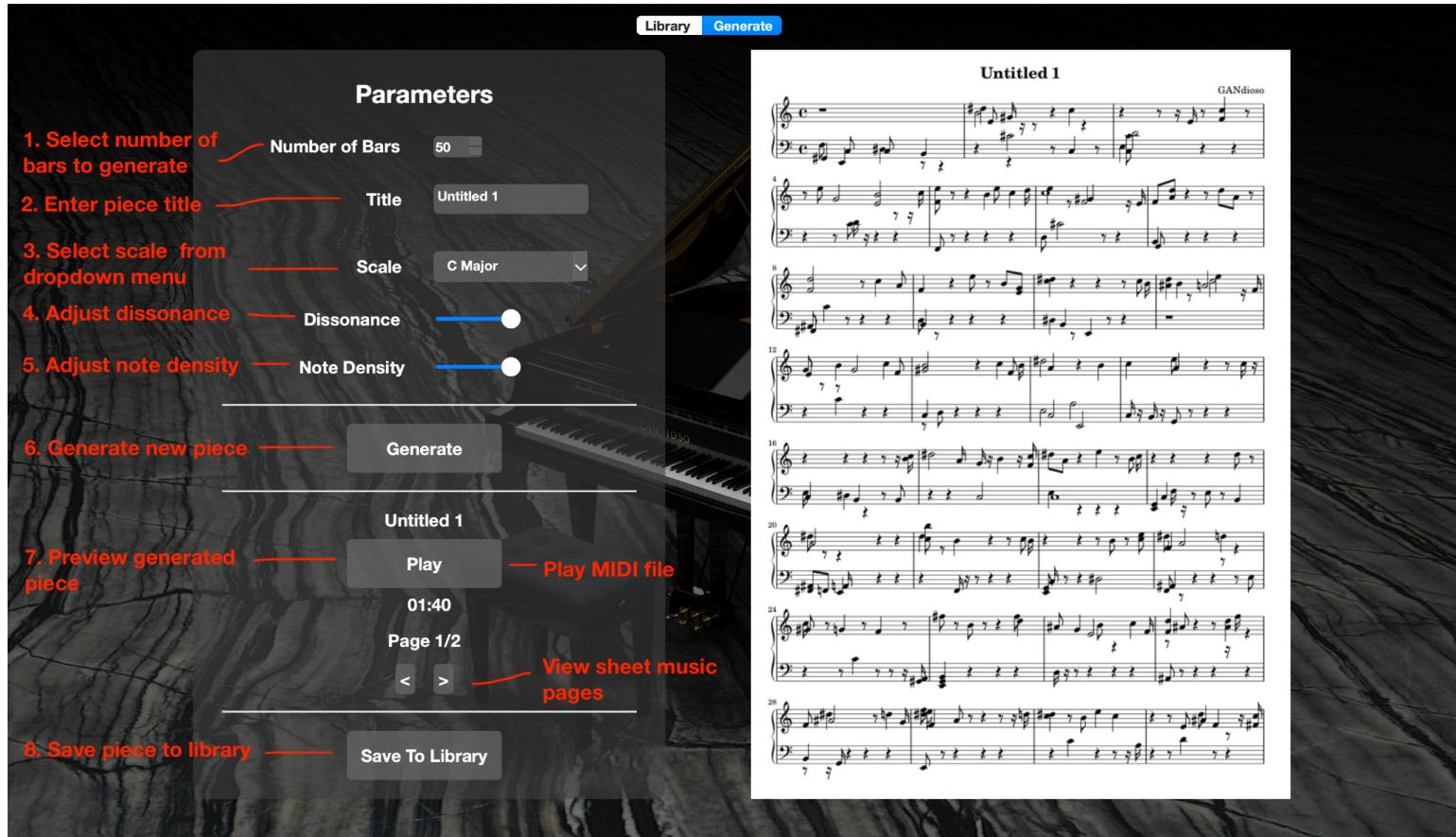


# GANDioso User Manual

## How To Use GANDioso

Using GANDioso is very simple: the GUI consists of two tabs, **Library** and **Generate**. The **Generate** tab is where you can generate new pieces, and generated pieces are saved to the **Library** tab, where you can open the PDF scores and listen to the MIDI files.

### Generating A Piece



1. Go to the '**Generate**' tab.
2. Adjust the parameters to your preference. Here is an explanation of what each Parameter does:
  - Number of Bars

The number of bars of music to generate, where each bar is written in 4/4. Accepts values from 10-100.

- Title

The title of the piece that will be displayed in the Library. An error message will appear if the title is already used or if it exceeds 15 characters.

- Scale

The scale, or key, of the generated piece. The Generative Adversarial Network (GAN) itself does not generate a piece in the specified key; the GAN output is processed to match the desired key.

- Dissonance

How dissonant the piece is (the proportion of notes that are not within the selected key).

- Note density

The number of notes in each section of music.

3. Press '**Generate**' to generate a new piece.
4. (Optional) Press '**Play**' to listen to the piece and '**Stop**' to stop listening, and press '**<**' and '**>**' to view all pages of the sheet music.
5. Press '**Save To Library**' to save the piece to the library, or '**Generate**' to generate another piece. Pressing '**Generate**' will delete the current piece if it has not been saved to the library.

### [View/Listen To Saved Pieces](#)

5/40

Library Generate

Untitled 1 Untitled 2 Untitled 3 Untitled 4 Untitled 5

Click to select piece

Untitled 5 GANdison

Previous Page Page 1/2 Next Page

01:40 < >

Play Open Score Delete

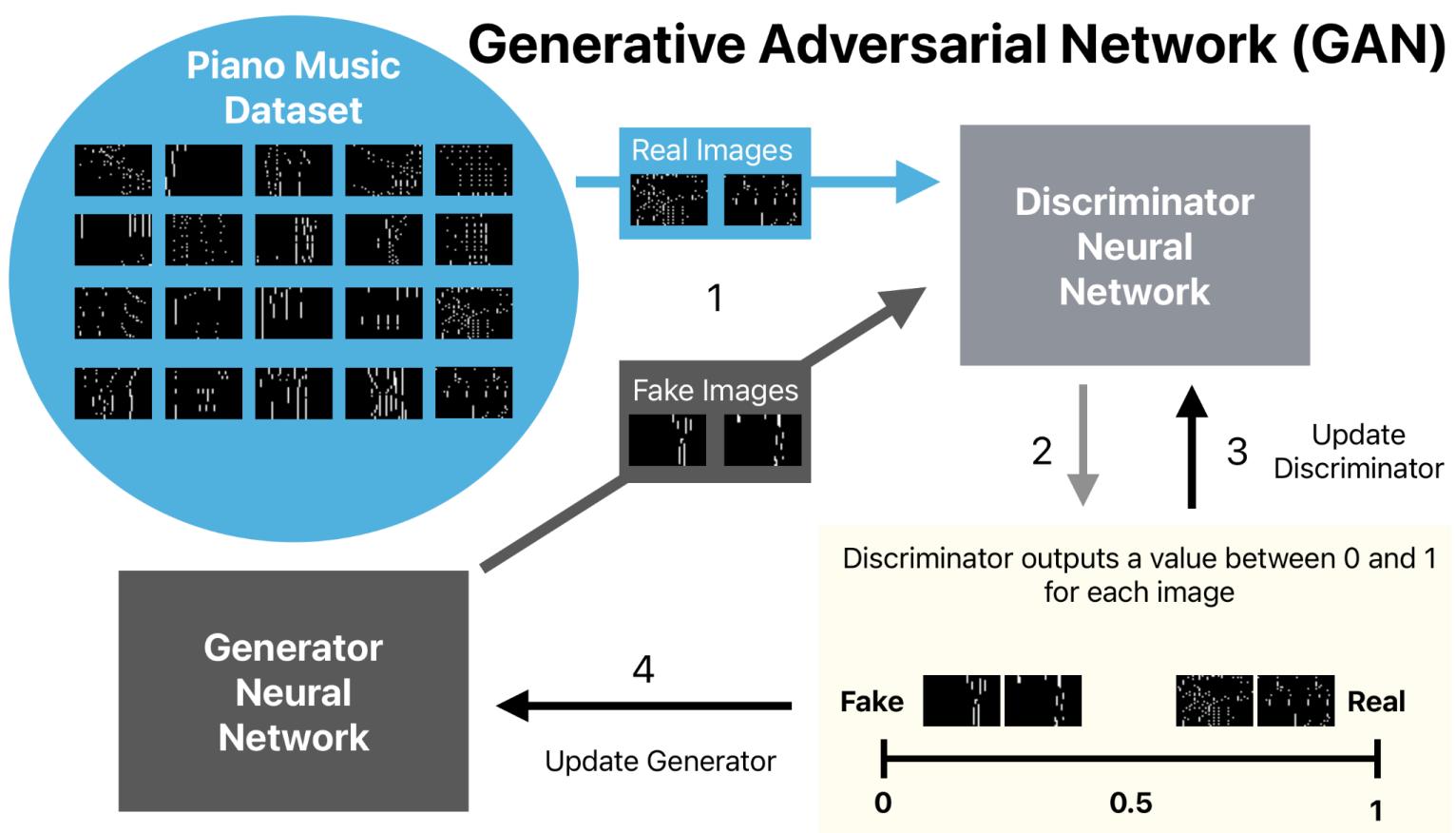
Play MIDI File Open PDF Score Delete Selected Piece

1. Go to the '**Library**' tab.
2. Click on the button with the name of a piece on it to select that piece.

3. Press ‘Play’ to listen to the piece and ‘Stop’ to stop listening, and press ‘<’ and ‘>’ to view all pages of the sheet music.
4. (Optional) Press ‘Open Score’ to open the PDF sheet music of the selected piece.
5. (Optional) Press ‘Delete’ to delete the selected piece.

### How GANDioso Generates Music

GANDioso generates music using a Generative Adversarial Network (GAN). A GAN consists of two neural networks: a *generator* and a *discriminator*. Below is a simplified overview of how a GAN works.

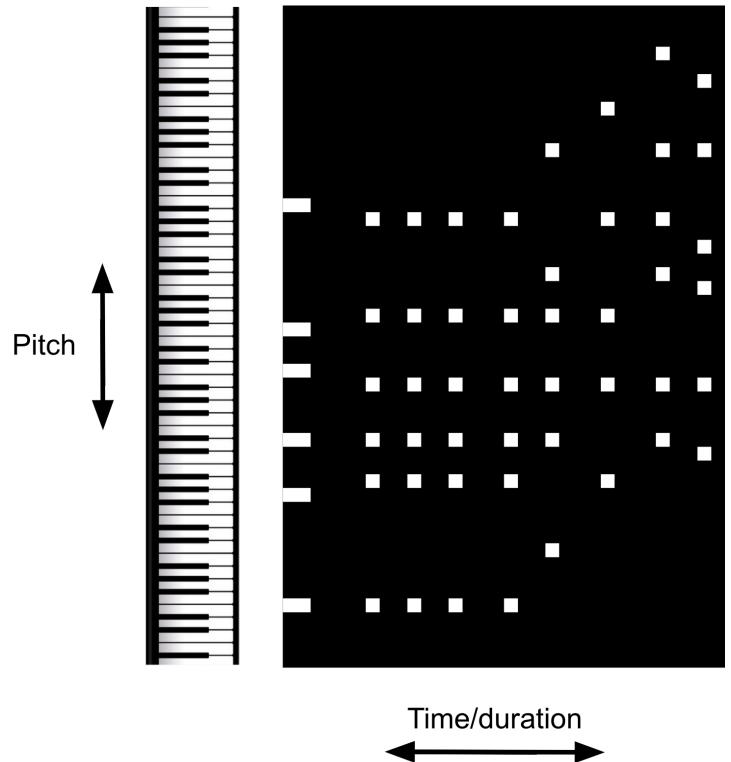


1. Real images taken from the dataset and fake images generated by the generator are fed into the discriminator.
2. The discriminator determines whether a given image is real or fake by calculating a value between 0 and 1 for each image, where 0 means that the discriminator thinks the image is fake and 1 means that it thinks the image is real. This value is used to determine how accurate the discriminator is.
3. The discriminator is updated so that it learns to more accurately distinguish between real and fake images.

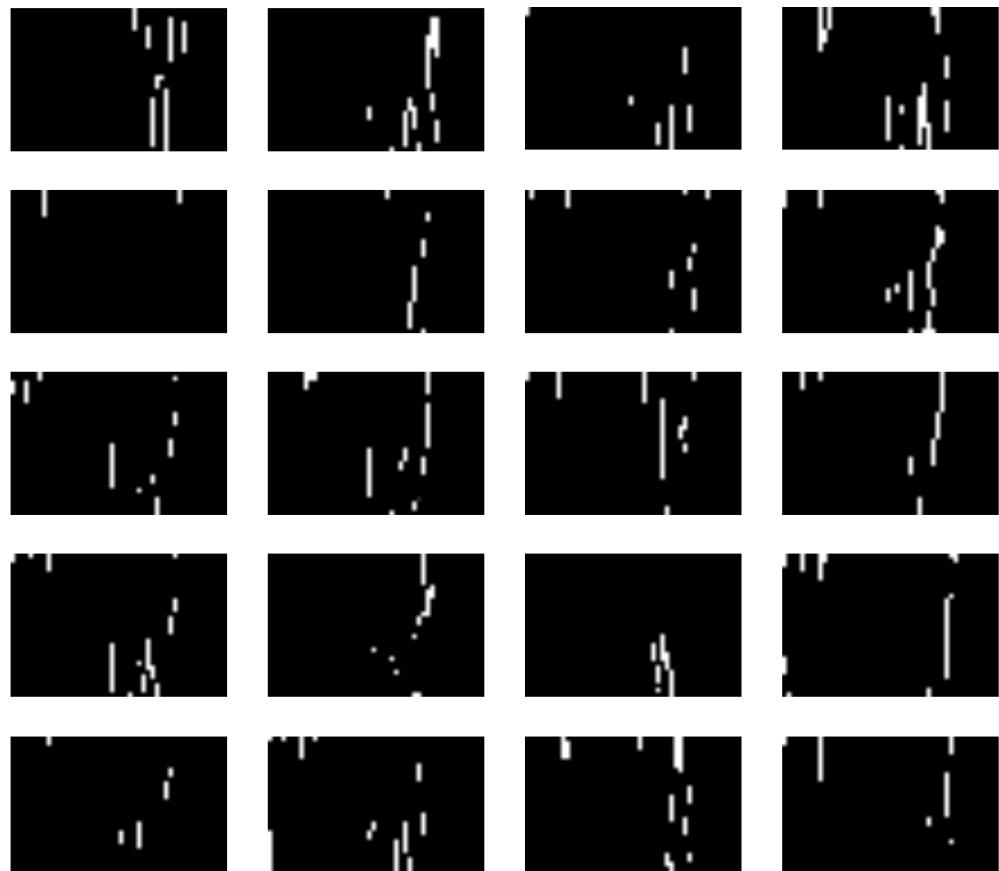
- The generator is updated so that it can generate more realistic images that trick the discriminator into thinking they are real when they are actually fake.

These steps are repeated many times, and both the generator and discriminator improve during this process until eventually the generator is able to generate realistic images.

The data used to train the GAN is a dataset of around 1500 piano MIDI files obtained from the MAESTRO Dataset and Classical Piano Midi Page. The notes from the MIDI files were preprocessed into around 200 000 images like the one on the right (which are actually two-dimensional arrays of 0s and 1s), where the horizontal axis represents duration and the vertical axis represents the pitch.



Once the GAN has been trained, it is able to generate images like these:



Once these sections of notes are generated, they are merged together to form a complete piece and assembled into Midi and PDF files.

To generate the MIDI files, notes in the images are encoded numerically and then written as Music21 objects, which are then turned into MIDI files by the Music21 library.



To generate the PDF sheet music, the notes in the images are written as strings. The Abjad library passes these strings into the Lilypond music engraving software which generates the PDF sheet music file.

```
Score("{ { { { r4 r4 e'4 f'4 } { s4 s4 s8 a'4 s8 } { d''16 s8 c'2 s8 } } { { d''16 g'16 r8 r8 a'4 r8 r4 } { f'2 s4 s8 d''8 } } { { r8 b'2 c'4 r8 } { s4 s4 s4 e'''4 } } { { d'8 r8 r4 r4 r8 r16 a'16 } { a'2 s4 s8 b'8 } } { { f'4 r4 r8 a'8 d''4 } { s4 s4 s8 e'''16 s16 s8 s16 a'16 } } { { d''2 r4 r8 r16 <a' b'>16 } } { { r16 a'4 r16 r8 r4 r4 } { f'8 s8 s4 s4 s4 } } { { e'''8 c'4 g'4 c'4 r8 } { s4 s8 b'8 s4 s4 } } { { f''4 r8 e'4 r8 r4 } { d'8 s8 <a' c'>2 s4 } } { { c''8 r8 f'8 r8 r8 d''4 r8 } { s4 b'2 s4 } } { { g'2 f'2 } } } } { { { { d8 r8 r4 r4 r4 } } { { b,8 r8 r4 r4 r4 } } { { <g, b,>4 r4 r8 d4 r8 } } { { e8 r8 d'2 r4 } } { { b,16 r16 r8 r4 r4 r4 } } { { r8 e,16 r16 c8 r8 r4 r4 } } { { s8 d8 s4 s4 s4 } } { { <b, d>8 a,4 r8 r4 r4 } } { { r4 c'8 r8 r4 r4 } } { { e,4 r4 r4 r4 } } { { r1 } } } ", name='Score', simultaneous=True)
```

