# Harmonizing Visuals: Transforming Images into Musical Notes with Python

# Introduction

*Harmonizing Visuals*: Exploring the fusion of *images* and *music* through Python's powerful capabilities. This presentation will delve into the process of transforming *visual data* into *musical notes*, unlocking the potential for creative expression and innovative exploration.

# Understanding Visual Data

In an image, pixels are composed of arrays of numbers that represent colors. The colour is expressed by RGB and HSV colour spaces, which can be subdivided into sections. Each note is defined by sound intervals. In a musical scale, notes are differentiated by sound intervals. Sound is a vibration, so each note has a particular frequency. In this way, a subdivision of colour space could be mapped to a specific musical note accompanied by a frequency.
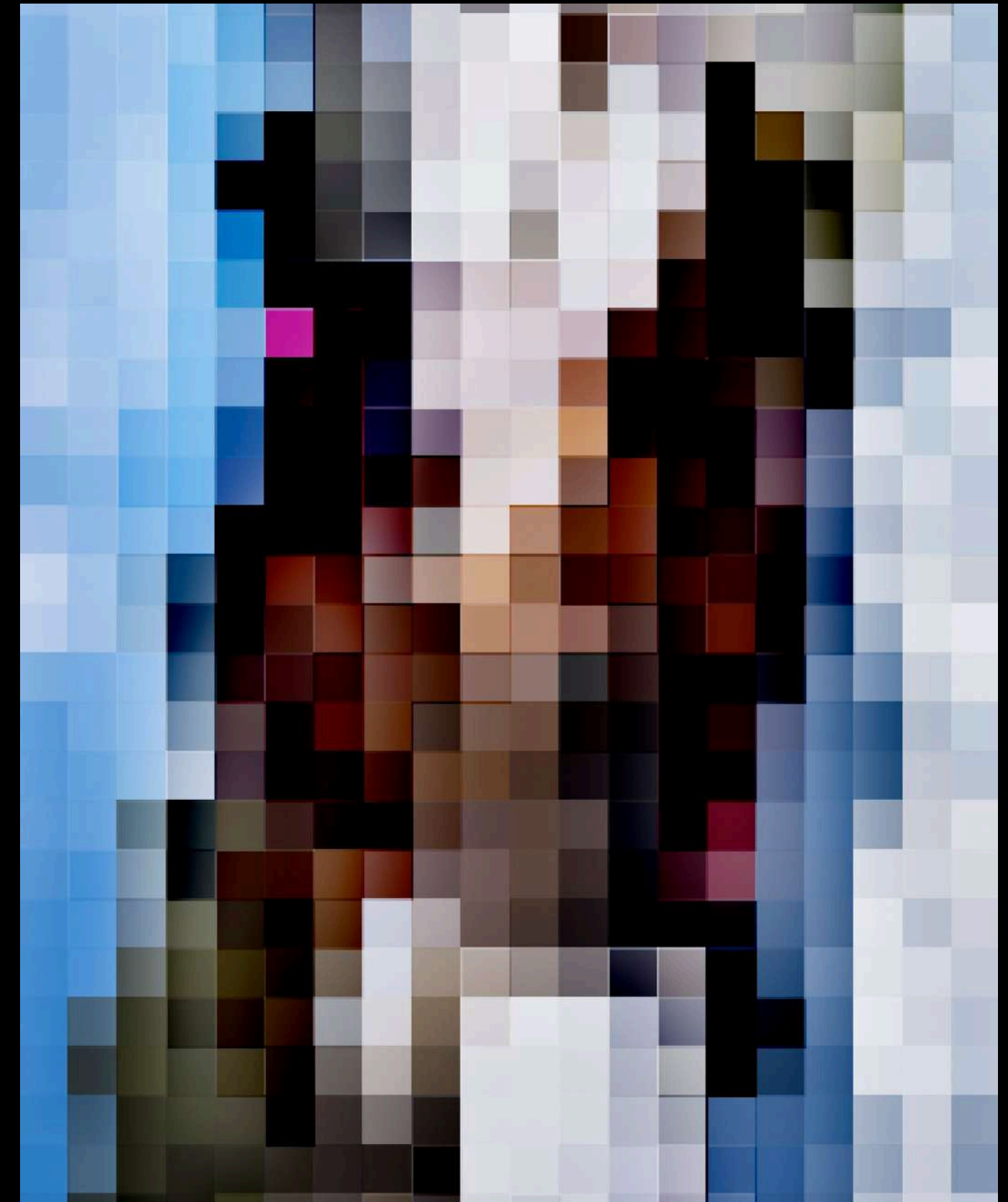
# Mapping Visuals to Sound

Leveraging Python's libraries to map *visual features* to musical properties. The process involves translating *brightness*, *color intensity*, and *spatial arrangement* into musical notes, creating a harmonious fusion of sight and sound.
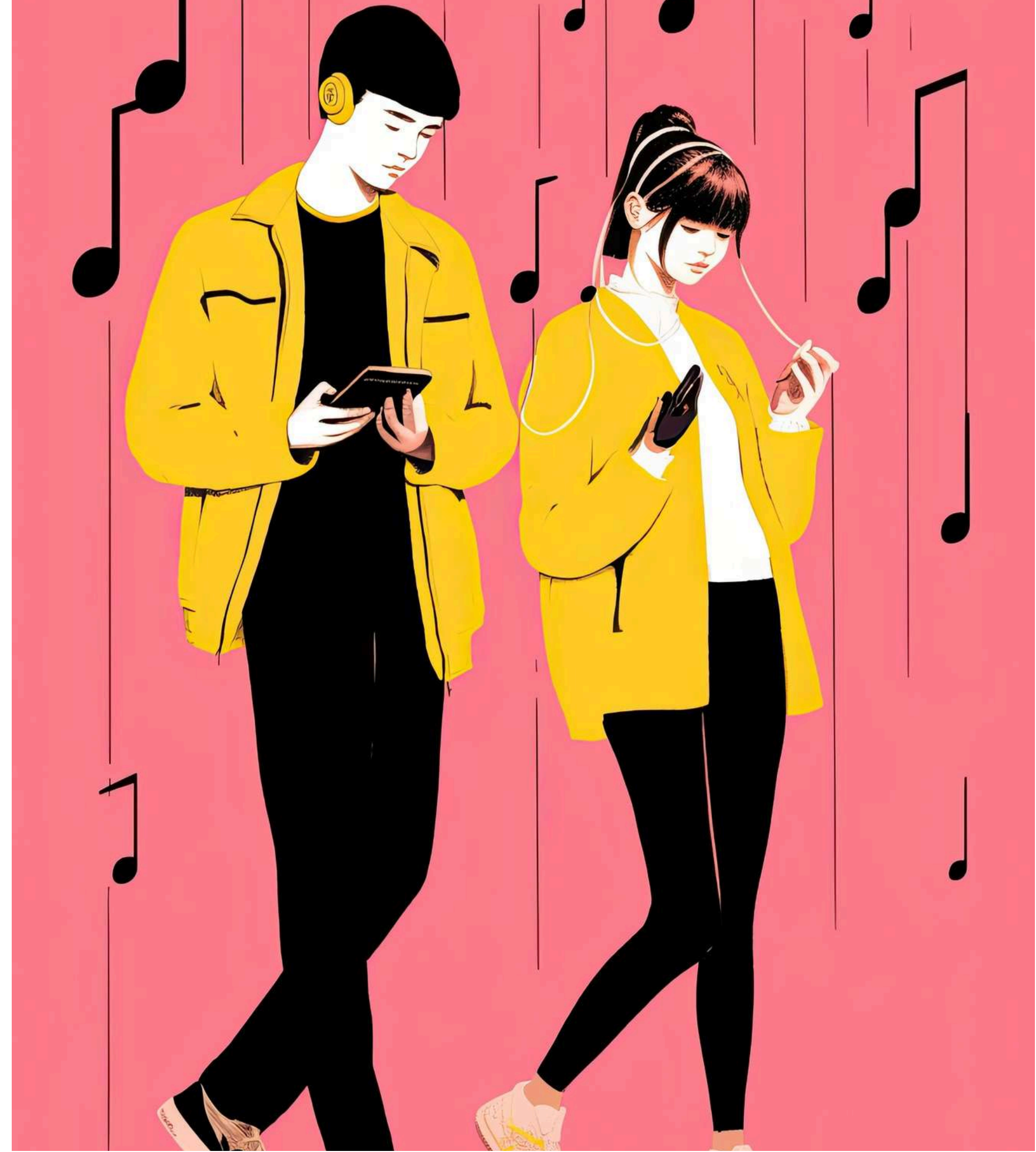
# Steps involved

- Color space extraction

- Scale Generation

- Frequency Mapping

- Addition of octaves

- Audio generation

# Colour Space Extraction

"Color is the degree to which a stimulus is similar or different to stimuli described as red, orange, yellow, green, blue, violet". Hue stands for color. In other words, saturation means how much a color is mixed with white. It is the ratio of color to brightness in an area. The luminance of a visual target creates the perception of brightness, while saturation is determined by how much black is in it.

An image's height and width can be used to calculate the hue value for each pixel.

# Scale Generation

Katie He explores Python and music in this article in an interesting manner.

To generate a dictionary of musical notes corresponding to the 88 keys on a standard piano that maps the 88 keys to frequencies in Hertz, I adapted one of her functions that maps piano notes to frequencies as the starting point for the song/scale generating routine.

Our next step is to define the scale intervals in terms of tones in order to be able to index the notes.

# Frequency Mapping

Harmonic frequency is a measure of the frequency of sound wave vibrations. It is measured in Hertz (Hz) and is used to describe the pitch of a musical note. A hue value can be converted into a frequency by mapping a set of frequencies to a hue value using a lookup table. It contains all the possible hue values and their respective frequencies.

# Octave Addition

Music is characterized by octaves, or intervals 2 full steps above or below a tone's fundamental frequency. The interval is used to create harmony in music. The sound of the melody can be thickened, thinned out, dynamics added, or complex harmonies developed. It is also possible to change the register of a note or play the same notes an octave higher to create the illusion of a new melody in a song.

# Audio generation

In order to make a playable audio file, it is necessary to convert the notes column into a numpy array called frequencies, using the wavfile.write function of SciPy, which gets the data converted according to the correct data type.

# Exploring New Frontiers

Embracing the potential for *innovation* and *exploration* in the realm of harmonizing visuals with music. The fusion of *artistic creativity* and *technical prowess* opens doors to new frontiers in *data-driven art* and *interactive experiences*, driving the evolution of creative expression.

# What's the AI in this

- From audio files, create a dataset of spectrograms, train a model to generate similar spectrograms, and convert the spectrograms into audio.
- Build our own virtual piano, generate waves at different frequencies, and play a song.
- Make a tool for highlighting notes on both a keyboard and guitar so to easily map scales between the two.
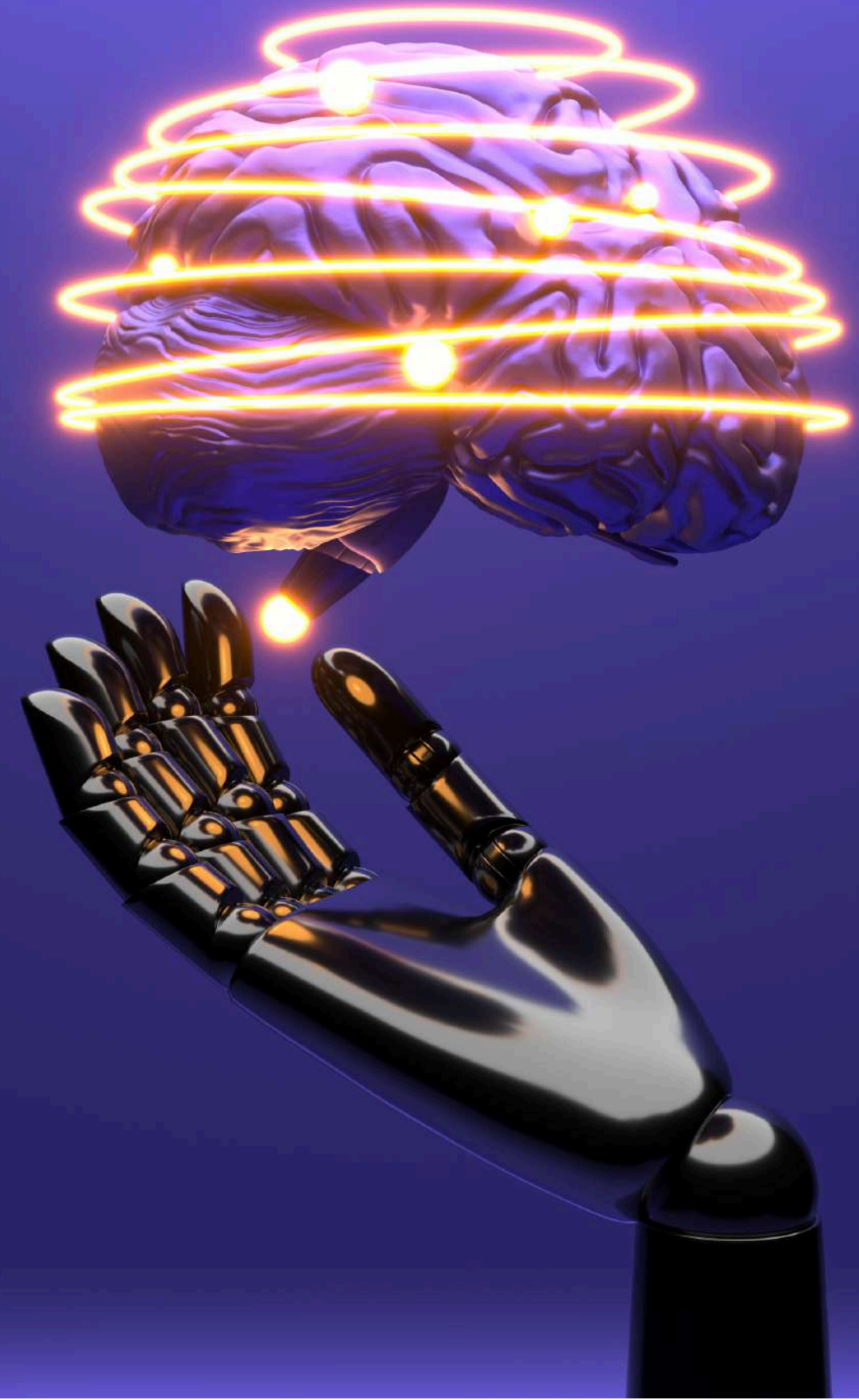
# Conclusion

*Transforming Images into Musical Notes* with Python presents an exciting convergence of art and technology. This innovative process unlocks new dimensions of creative expression and paves the way for groundbreaking applications in the realms of *digital art*, *music composition*, and *interactive experiences*.

# Thanks!

Do you have any questions?