
Moire Documentation

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Multi-Objective Interactive Runtime Environment



The official GUI for *Artipixoids!* project.

It is integrating natively with *Xentica* framework, but you may also use it to visualize your own step-by-step simulations.

The engine is dealing nothing with rendering, it's relying fully on frames rendered with your simulation. The main Moire purpose is to automatically build GUI that gives you control over simulation's parameters, change them at runtime, save/load experiments, shoot videos, etc.

Warning: Current version is a work-in-progress, it works to some degree, but please do not expect something beneficial from it. As planned, really useful stuff would be available only starting from version 0.3.

If you brave enough to ignore the warning above, dive right into this guide. Hopefully, you will manage to install Moire on your system and at least run some examples.

1.1 Installation Instructions

Moire is built upon [Kivy](#) framework, it is the main dependency for its core functionality. Also, you need [NumPy](#) in order to run examples and tests.

Note: This page currently containing instructions only for Debian-like systems. If you are on other system, you still can use links to pre-requisites in order to install them. If so, please contact us by [opening an issue](#) on GitHub. We could help you if you'll meet some troubles during installation, and also your experience could be used to improve this document.

1.1.1 Prerequisites

- [Python 3.5+](#)

Your distribution should already have all you need:

```
$ sudo apt-get install python3 python3-dev python3-pip wheel
```

- [Kivy](#)

Its pre-requisites could be installed by:

```
$ sudo apt-get install \  
build-essential \  
git \  
ffmpeg \  

```

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```
libsdl2-dev \  
libsdl2-image-dev \  
libsdl2-mixer-dev \  
libsdl2-ttf-dev \  
libportmidi-dev \  
libswscale-dev \  
libavformat-dev \  
libavcodec-dev \  
zlib1g-dev
```

Then, to install stable Kivy:

```
$ pip3 install Cython==0.25 Kivy==1.10.0
```

On latest Debian distributions you can meet conflicts with `libsdl-mixer`. Then, try to install latest developer version, like:

```
$ pip3 install Cython==0.27.3 git\+https://github.com/kivy/kivy.git
```

1.1.2 Main package

Moire package could be installed with:

```
$ pip3 install moire
```

Note, it does not depends on pre-requisites described above, but you still need to install them properly, or Moire will not run.

1.1.3 Run Moire examples

In order to run Noise TV environment with Moire:

```
$ pip3 install numpy  
$ pip3 install moire  
$ wget https://raw.githubusercontent.com/a5kin/moire/master/examples/noisetv.py  
$ python3 game_of_life.py
```

1.1.4 Run tests

In order to run Moire tests:

```
$ git clone https://github.com/a5kin/moire.git  
$ cd moire/tests  
$ ./run_tests.sh
```

1.2 Tutorial

Tutorial is coming soon. Meanwhile, you may check the official Noise TV example.


```

"""
The example showing how to build an environment runnable with Moire.

We will set up Noise TV environment, which is generating a
pseudorandom array each step, then render it to a viewport as
necessary.

"""

import numpy as np

import moire

class NoiseTV:
    """
    Welcome to the Noise TV.

    You will find nothing but a pseudorandom noise here, 24/7. Just
    relax, stare at the screen for some time, and your imagination
    could start playing games with you.

    """

    def __init__(self):
        """
        Initialize the environment.

        Some attributes are mandatory for this class, since Moire is
        relying on them:

        ``timestep``
            A positive integer, holding current time step number. You
            must properly increment it in ``step()`` method.
        ``speed``
            An integer >= 1, representing the simulation speed, or
            exactly the number of steps per visualization frame.
        ``paused``
            A flag showing if simulation is paused or running.
        ``bridge``
            A bridge class between Moire and your environment.

        """
        self._size = 3
        self._screen = np.zeros((self._size, ), dtype=np.uint8)
        self.timestep = 0
        self.speed = 1
        self.paused = False
        self.bridge = MoireBridge

    def set_viewport(self, size):
        """
        Set viewport (camera) size and initialize array for it.

        :param size: tuple with width and height in pixels.

        """

```

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```

self._size = size[0] * size[1] * 3
self._screen = np.zeros((self._size, ), dtype=np.uint8)

def apply_speed(self, dval):
    """
    Change the simulation speed.

    :param dval: Delta by which speed is changed.

    """
    self.speed = max(1, (self.speed + dval))

def toggle_pause(self):
    """
    Toggle ``paused`` flag.

    When paused, the ``step()`` method does nothing.

    """
    self.paused = not self.paused

def step(self):
    """
    Perform a single simulation step.

    ``timestep`` attribute will hold the current step number.

    """
    if self.paused:
        return
    self._screen = np.random.randint(0, 255, (self._size, ),
                                     dtype=np.uint8)
    self.timestep += 1

def render(self):
    """
    Render the field at the current timestep.

    You must call :meth:`set_viewport` before do any rendering.

    :returns:
        NumPy array of ``np.uint8`` values, ``width * height * 3``
        size. The RGB values are consecutive.

    """
    return self._screen

class Bridge:
    """Main bridge class containing basic functions."""

    @staticmethod
    def exit_app(_env, gui):
        """Exit GUI application."""
        gui.exit_app()

    @staticmethod

```

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```
def speed(dspeed):
    """Change simulation speed."""
    def func(env, _gui):
        """Wrap speed applying."""
        env.apply_speed(dspeed)
    return func

@staticmethod
def toggle_pause(env, _gui):
    """Pause/unpause simulation."""
    env.toggle_pause()

@staticmethod
def toggle_sysinfo(_env, gui):
    """Turn system info panel on/off."""
    gui.sysinfo.toggle()

class MoireBridge:
    """Class incapsulating the actions for Moire UI."""

    key_actions = {
        "[": Bridge.speed(-1),
        "]": Bridge.speed(1),
        "spacebar": Bridge.toggle_pause,
        "f12": Bridge.toggle_sysinfo,
        "escape": Bridge.exit_app,
    }

def main():
    """Run the whole environment with Moire."""
    environment = NoiseTV()
    gui = moire.GUI(runnable=environment)
    gui.run()

if __name__ == "__main__":
    main()
```


2.1 Moire

The official GUI for [Artipixoids!](#) project.

It is integrating natively with [Xentica](#) framework, but you may also use it to visualize your own step-by-step simulations.

The engine is dealing nothing with rendering, it's relying fully on frames rendered with your simulation. So, you should manually implement the stuff like zooming or scrolling, and bind the actions to keyboard/mouse/etc events.

The only thing Moire doing right now, is keeping the rate of your rendered frames, speeding simulation up/down as necessary. Also, system info dialog is included, showing current timestep, frames/steps per second and simulation speed.

2.1.1 Main App (moire.main)

Main module containing the base class for Moire GUI.

All Moire apps should be ran using `GUI` class. See the example below.

```
class moire.main.GUI (**kwargs)
```

```
    Bases: object
```

```
    Main class for moire GUI.
```

```
    Moire apps should be ran with it in following way:
```

```
runnable = YourRunnable()
gui = moire.GUI(runnable=runnable)
gui.run()
```

The engine is fully relying on your custom runnable class. It should implement a number of features like perform a simulation step, render frame etc. See the detailed example in the official [NoiseTV](#) example.

Parameters `runnable` – Runnable class, implementing all necessary features.

build()

Prepare GUI for running.

class moire.main.MainEngine (*app*, **args*, ***kwargs*)

Bases: object

Class encapsulating main Moire engine functionality.

Parameters *app* – GUI class instance.

background = <ObjectProperty object>

Kivy property containing Rectangle with rendered frames.

exit_app()

Exit the app in convenient way.

key_down (*key*)

Emulate key down.

prepare()

Do main preparations before app run.

runnable = <ObjectProperty object>

Kivy property containing runnable class.

update (*_dt*)

Update the whole app, while keeping the frame rate.

update_sysinfo()

Update System Info widget with actual data.

viewport = <ObjectProperty object>

Kivy property containing rendered frames as Texture.

class moire.main.ObjectProperty

Bases: object

2.2 Widgets (moire.widgets)

The package with the widgets and UI components.

You may use `widgets` package as a shortcut to the following classes.

- `widgets.PanelWidget` → `moire.widgets.panel.PanelWidget`
- `widgets.SystemInfoWidget` → `moire.widgets.sysinfo.SystemInfoWidget`
- `widgets.DescriptiveList` → `moire.widgets.dlist.DescriptiveList`

2.2.1 Descriptive List (moire.widgets.dlist)

The module with a two-column param-value list.

class moire.widgets.dlist.DescriptiveList (*fields*, *item_width*, *item_height*=25, ***kwargs*)

Bases: object

The widget representing key-value descriptive list.

Initially, values are empty, but could be changed at runtime like:

```
my_list = DescriptiveList(['Foo', 'Bar'], 200, 200)
# ...sometimes later
my_list['Foo'] = '235'
```

Parameters

- **fields** – A list of field names, to be shown at the left column in bold font. This will also be keys for values access.
- **item_width** – The width of the item in inner units.
- **item_height** – The height of the item in inner units.

2.2.2 Panel Base (moire.widgets.panel)

Module with the base Panel class.

```
class moire.widgets.panel.PanelWidget (**kwargs)
    Bases: object
```

The implementation of the base panel widget.

Other widgets could be inherited from Panel in order to get the standard visual decoration and show/hide transitions.

```
redraw (*_args)
    Redraw panel on the canvas.
```

```
toggle ()
    Toggle show/hide the panel with its contents.
```

2.2.3 System Info (moire.widgets.sysinfo)

Module for widget with system info.

```
class moire.widgets.sysinfo.NumericProperty
    Bases: object
```

```
class moire.widgets.sysinfo.SystemInfoWidget (**kwargs)
    Bases: moire.widgets.panel.PanelWidget
```

Build-in widget showing system info.

The fields are:

- FPS** Current frames per second speed (for GUI).
- SPS** Current steps per second speed (for simulation).
- Speed** How many steps are skipped each frame.
- Time** Global timestep counter.

```
fps = <NumericProperty object>
    Desired frame rate
```


CHAPTER 3

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