Simulation_Super_Brownian_Motions

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CONTENTS:

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CHAPTER

ONE

SUPER_BM_SIMULATION

Super Brownian motion is also called *superprocess* in the literature. Check out the Wikipedia page for Superrpocess and the book by Etheridge [Eth00].

1.1 Module contents

This module simulates branching Brownian motions and includes a variety of functionalities:

- **Simulate the Motion**: Create simulations of branching Brownian motions.
- **Plot Paths**: Plot the paths of the motion and save them in JPEG and PNG formats.
- **Export Data**: Export the sample paths to CSV files for further analysis.
- **Generate Animation**: Create an animation of the branching Brownian motion process.

Credits:

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class super_bm_simulation.**Branching_BM**(*num_steps=301*, *update_steps=100*, *branching_prob=0.5*, *scale=10*, *seed=42*)

Bases: `object`

Initialize the Super Brownian Motion simulation with given parameters.

Parameters

- **num_steps** (*int*) – Number of steps in the simulation. Default is 301.
- **update_steps** (*int*) – Number of steps between each update. Default is 100.
- **branching_prob** (*float*) – Probability of branching at each step. Default is 0.5.
- **scale** (*float*) – Scale factor for the motion. Default is 10.
- **seed** (*int*) – Seed for random number generation. Default is 42.

Animation(*dpi=150*)

Generate the animation of the branching Brownian motion.

`Branch_or_Die`(*path_id*, *step*)

Update the specified path based on the branching and dying logic.

This method applies the branching and dying logic to the path identified by path_id at the given simulation step. It determines whether the path should branch, continue, or die.

Parameters

- **`path_id`** – The identifier of the path to be updated.
- **`step`** – The current step in the simulation process.

Returns

A boolean value; True if the path is still alive after this step, False if it has died.

`One_Step`(*path_id*, *step*)

Go one step for a path.

`export_paths`()

Export the paths in csv file.

`plot_paths`()

Plot all the paths of the Brownian motions.

`simulate`()

Run the simulation of the Brownian motion with branching.

`super_bm_simulation.`**`main`**`()`

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[Eth00] Alison M. Etheridge. *An introduction to superprocesses*. Volume 20 of University Lecture Series. American Mathematical Society, Providence, RI, 2000. ISBN 0-8218-2706-5. URL: https://doi.org/10.1090/ulect/020, doi:10.1090/ulect/020.

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