Capstone Project ISA Review #2
(Final application procedure)

Classical Monte Carlo analysis
(Markov chain Monte Carlo simulations)

Project Title : Quantum Monte Carlo Algorithm
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Phase 2-Steps taken towards final application procedure

- Phase 2 is the steps taken towards final applications of data point prioritization
- In Phase 2 we implement the well known estimation of π problem using Markov chain Monte Carlo procedure.
- We first implement an 1D icing problem simulation .
- Then estimation of pi as 2D Markov chain Monte Carlo problem .

1D icing model simulation

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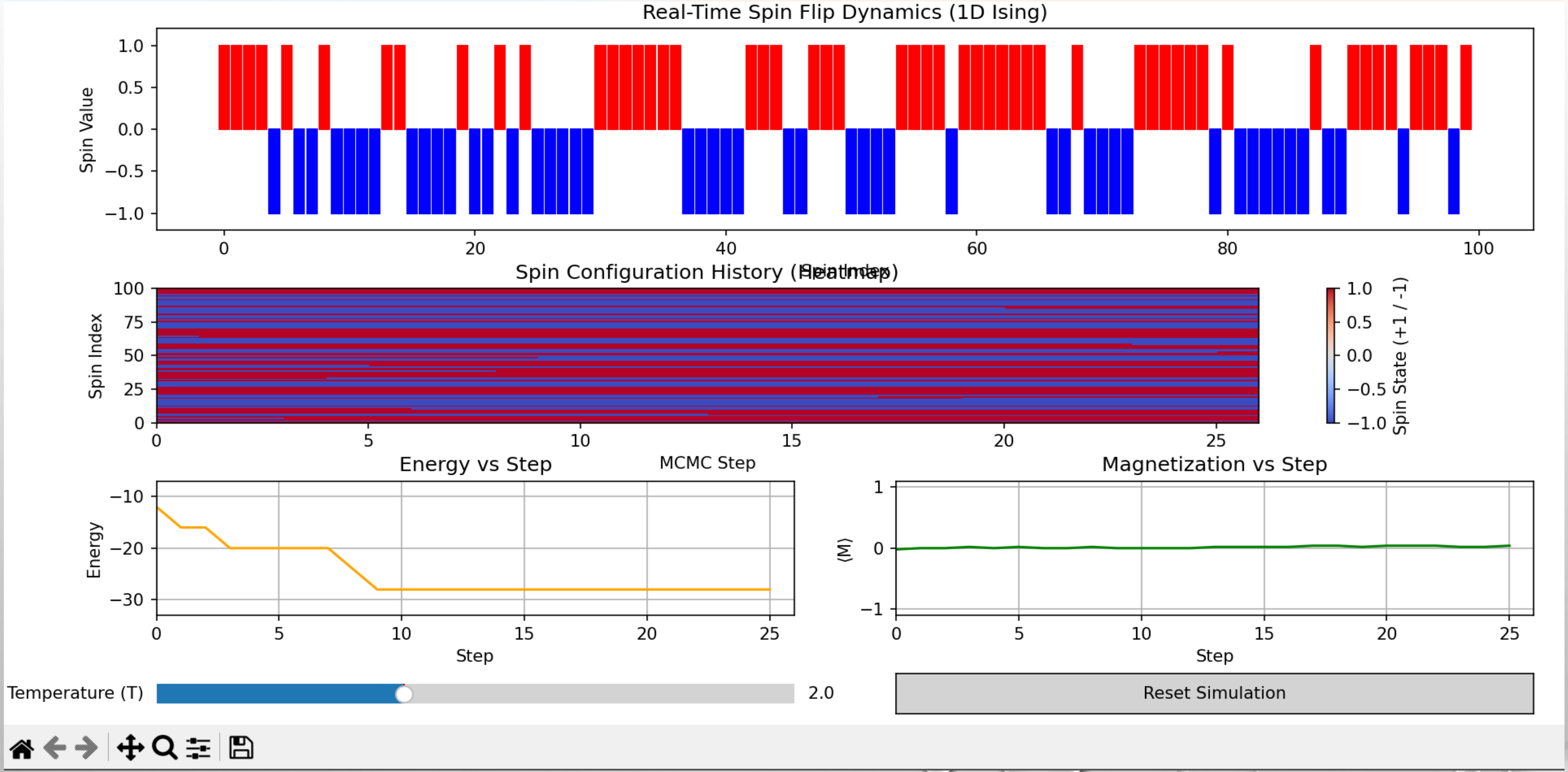
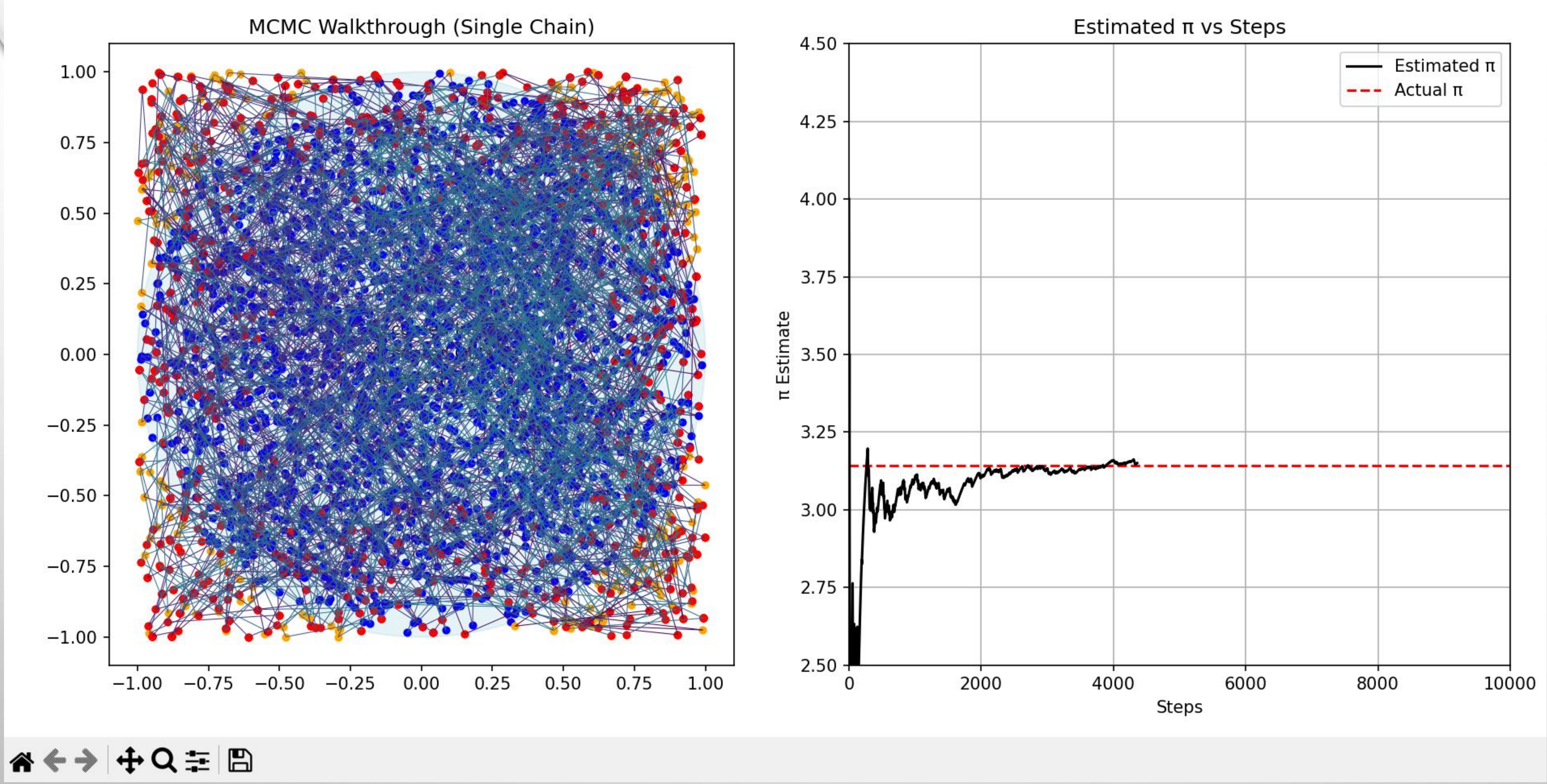


Limitations of MCMC Algorithm

- Higher error rates as samples are not inherently Independent
- Solution

- We discard the first n samples which in tis case have high error rates . This is called burn in period



Final Estimated π (post burn-in): 3.136000

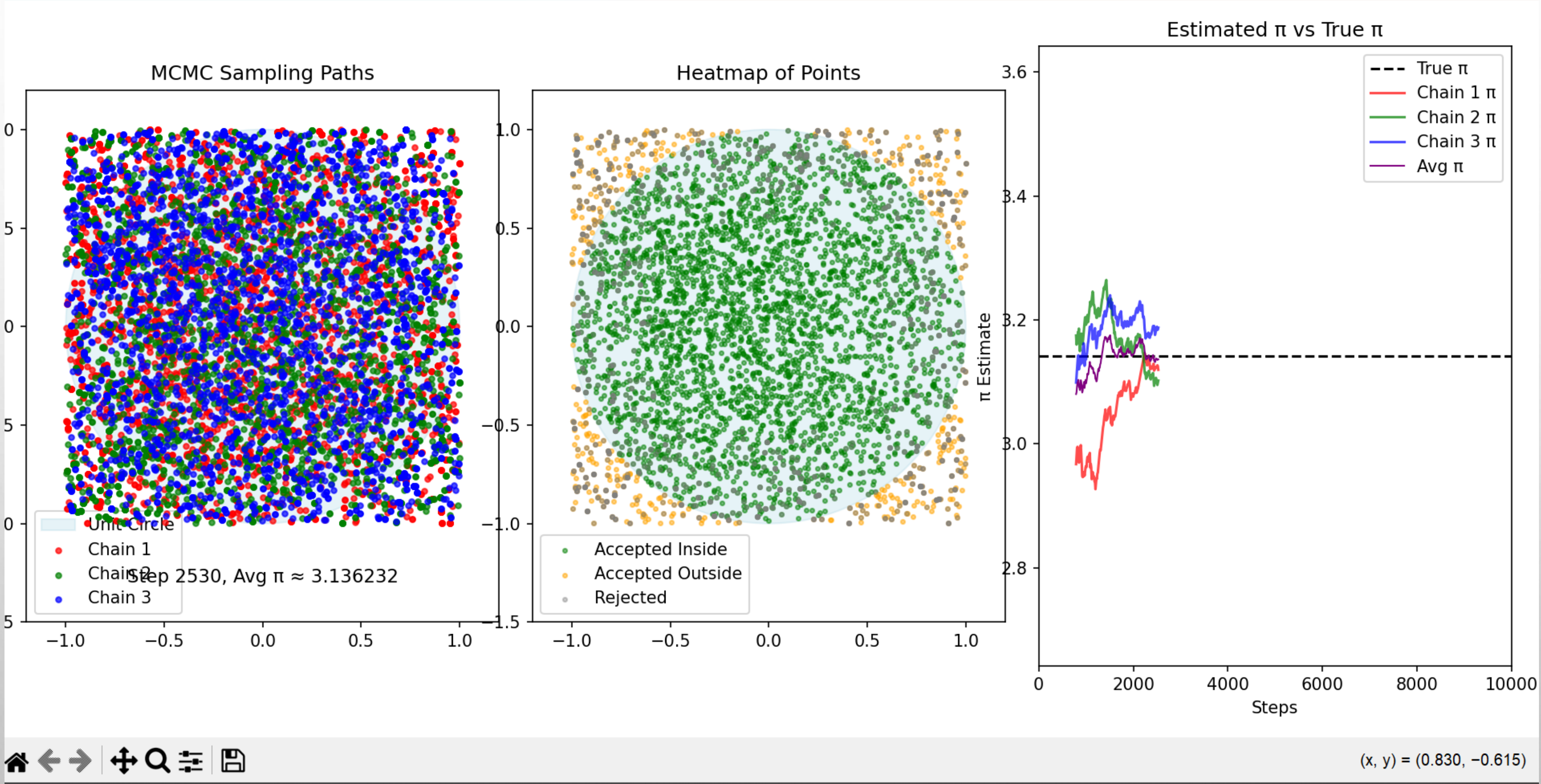
π Estimation Error: 0.005593

Time Taken: 0.08 seconds

Percentage error: 0.18%

Methods to improve the accuracy of MCMC

- We can use multiple markov chains with a burn in period and the final result is an average of the multiple chains



Chain 1 π estimate: 3.177333 | Error: 0.035741 (True π: 3.141593)
Chain 2 π estimate: 3.120000 | Error: 0.021593 (True π: 3.141593)
Chain 3 π estimate: 3.136889 | Error: 0.004704 (True π: 3.141593)
Final Average Estimated π over 3 chains: 3.144741   Total computation time: 0.19 seconds   Absolute Error of Average π: 0.003148
Percentage Error of Average π: 0.1002%

Summary of Phase 2

In conclusion to phase 2 the key points are :
To proceed towards Data point prioritization problem we modify the classical Monte Carlo with Markov chains fitted with burn in error correction

- This vastly improves time complexity and also improves the error %

Future execution plans

The next phase of our project involves 3 Approaches

1)We solve pure 3D lattice using Quantum MCMC

2)We convert the 3D lattice into N 2d lattices solve them via Classical MCMC and integrate the results via Quantum computing

3)We make a comparison between the 2 and give comprehensive analysis

4)We will have an algorithm that is able to process data points and prioritize them with lower error rates

Thank You