Dissertation Presentation

Hidden Markov Models for Rainfall Simulation

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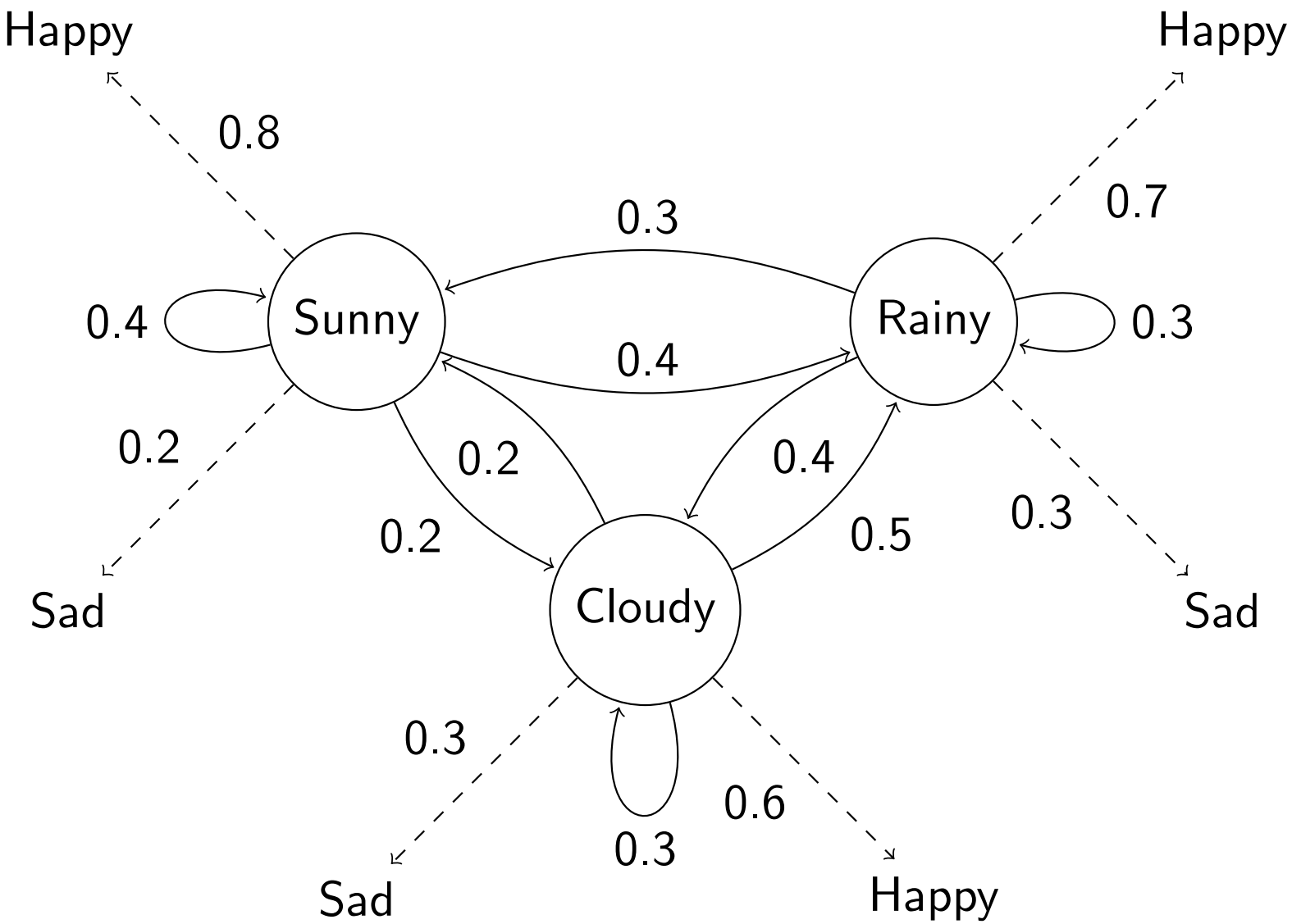
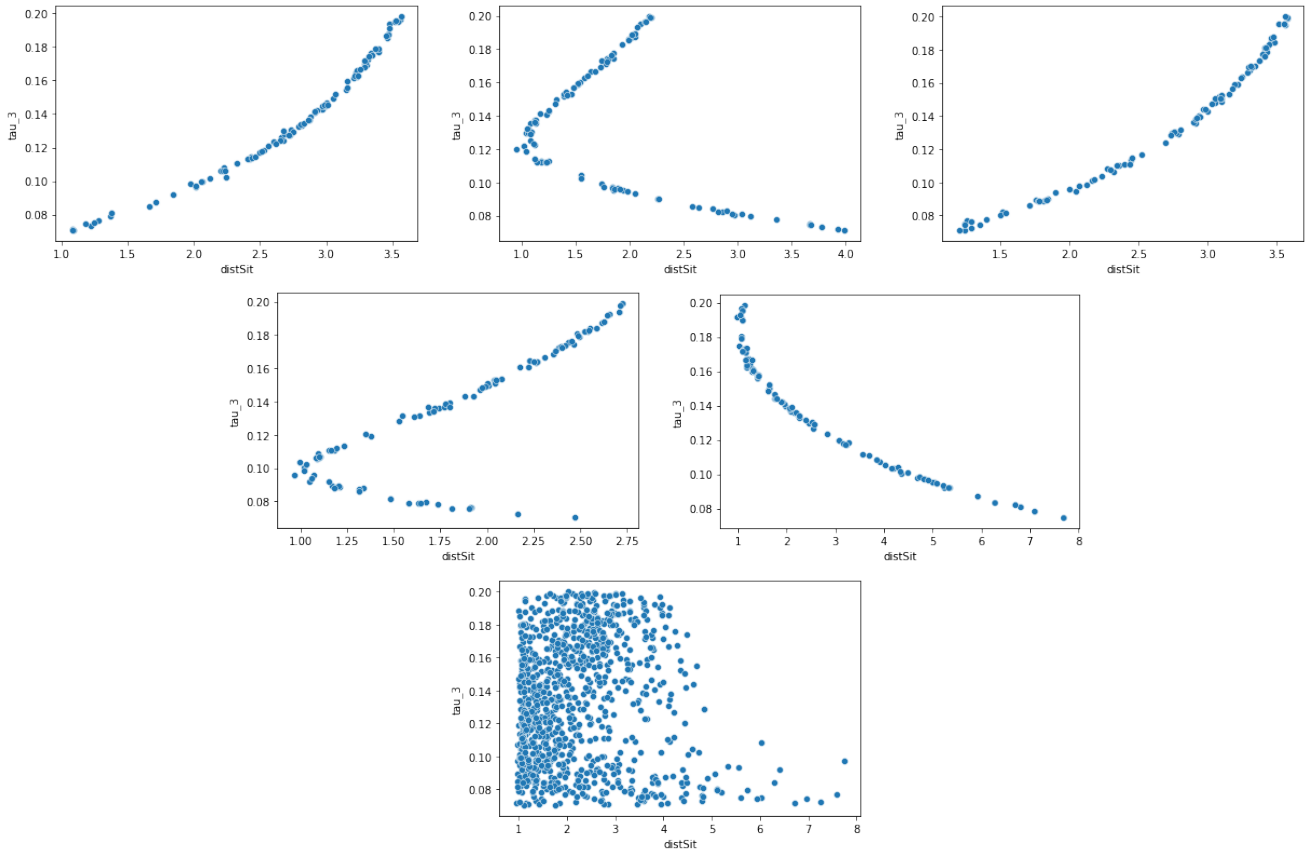
Outline

Hidden Markov Models



Rainfall Models

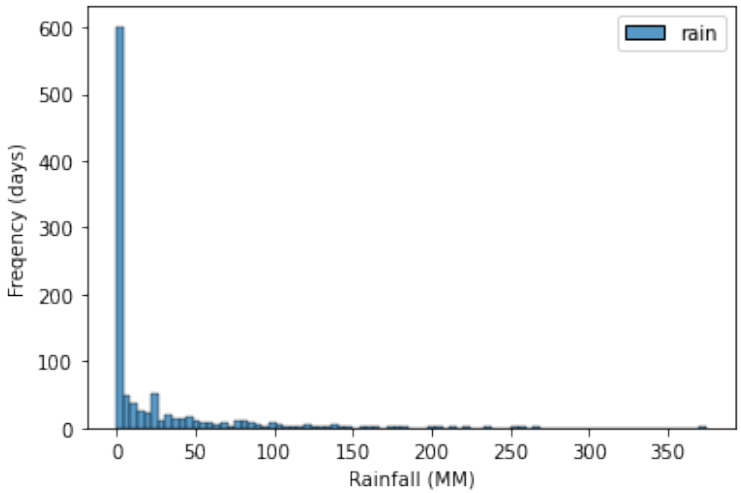
Using Grando's model and fitting methodology, we run multiple attempts on estimating parameter τ_3 but find different estimates.
The uniform scatter is for the adjusted algorithm.

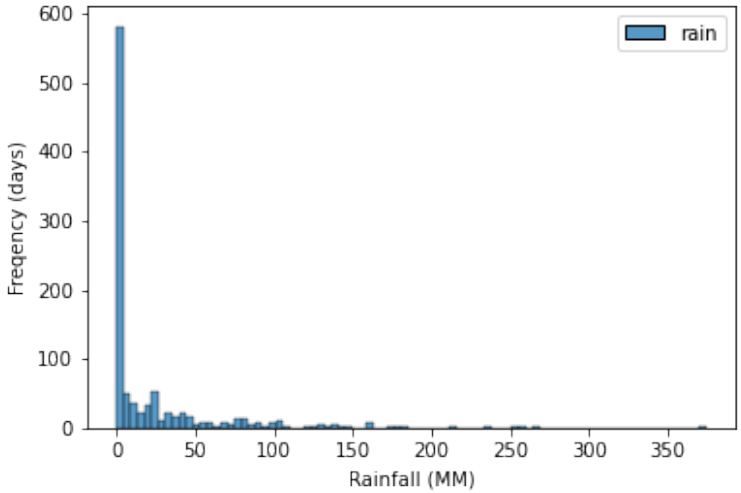


distSit = normalised Euclidean Distance between sample and simulation

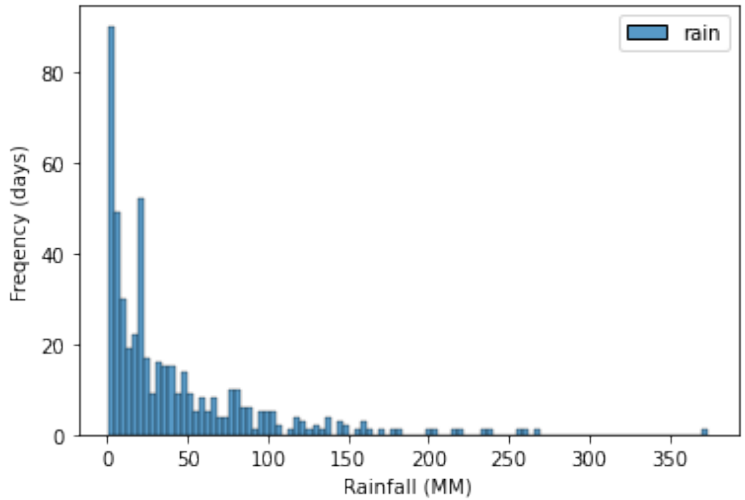
Simple Rainfall HMM

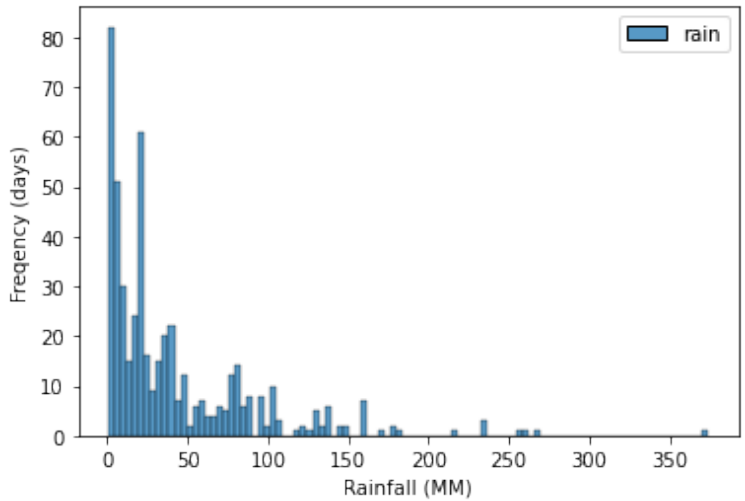
Sample(Top) vs Simulated(Bottom) data Frequencies





Sample(Top) vs Simulated(Bottom) data Frequencies not including 0mm days





Generalised Model

First row

$\lambda \in [0, 10]$

$\tau \in [0, 10]$

Second Row

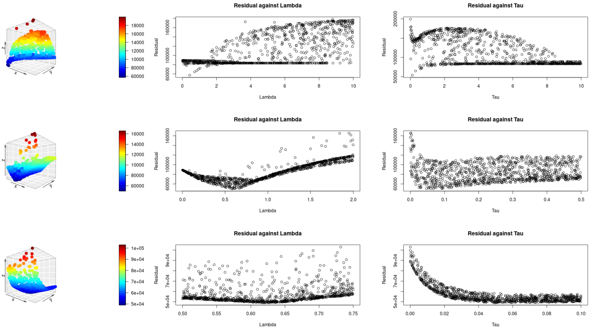
$\lambda \in [0, 2]$

$\tau \in [0, 0.5]$

Third Row

$\lambda \in [0.5, 0.75]$

$\tau \in [0, 0.1]$



Results

Kolmogorov–Smirnov tests

- H_0: The two samples are from the same distribution
- H_1: The two samples are not from the same distribution.

	Train	Train	Test	Test
Month	HMM	Gen Model	HMM	Gen Model
0	0.8593	4.939×10^{-5}	0.7899	4.60×10^{-8}
1	0.9969	0.002038	0.105	5.46×10^{-6}
2	1	2.13×10^{-5}	0.1118	7.65×10^{-7}
3	1	1.79×10^{-6}	0.02163	1.11×10^{-7}
4	0.4324	1.38×10^{-5}	0.0009582	7.98×10^{-8}
5	1	0.006202	0.2979	0.0004948
6	1	1.11×10^{-5}	0.1809	8.53×10^{-8}
7	1	2.13×10^{-5}	0.03555	4.53×10^{-5}
8	0.9999	0.0001108	0.07192	0.001033
9	0.9969	6.06×10^{-5}	5.22×10^{-7}	1.22×10^{-7}
10	0.8879	0.0008667	0.1914	9.07×10^{-5}
11	0.9999	6.06×10^{-5}	0.265	2.15×10^{-6}

Future Research

- Models with more and less than three states
- Increased number of Baum-Welch attempts
- Improved Generalisation of Observation Matrix