RAINFALL AND TEMPERATURE PREDICTION USING MARKOV CHAINS: A STUDY FOR SRI LANKA

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The right amount of rainfall and temperature conditions at the right time is very important for a country like Sri Lanka which depends on rainwater to fulfill agricultural, water supply and power generation needs of the people. In this study a Markov chain and state transition matrix based approach was taken to predict the most likely weather (rainfall, minimum and maximum temperature) in the near future. Such an approach was chosen due to the simplicity of this method compared to complex dynamic weather prediction methods. Multiple state-state transition matrices were used in this study to calculate state transition probabilities in four monsoonal seasons in Sri Lanka separately. The study was conducted in 5 locations in Sri Lanka covering all 3 climate zones of the country. Rainfall, minimum and maximum temperature data for 31 years in each location was used to calculate and validate state transition probabilities, for each monsoon period (in Sri Lanka) individually to capture the seasonal variability. Data were divided in to 5 categories (states) to obtain three categorical variables from continuous weather data. A technique based on a boxplots was used. Based on the probabilities of transition from one state to another state, transition matrices were built for each scenario. These matrices were then validated by comparing with state transition matrices built for the last 6 years. The validation was done with the help of an error percentage and this error percentage was found to be low for transition within states 2, 3 and 4 but high for states 1 and 5 in the case of temperature and state 5 only in the case of rainfall, which contained extreme values. The above procedure was repeated after removing extreme values from the data set, and calculated state transition matrices had lower error after the removal of extreme values. Unique stationary probabilities were also calculated for each scenario in each location. The probability of having a dry day during the 2nd inter-monsoon and south-west monsoons were found to be low compared to the other periods while having an exceptionally cold day is found to be more likely than having an exceptionally warm day. Finally using state transition probability and unique stationary probability information the probability of rainfall or temperature falling to a particular state in following days was calculated.