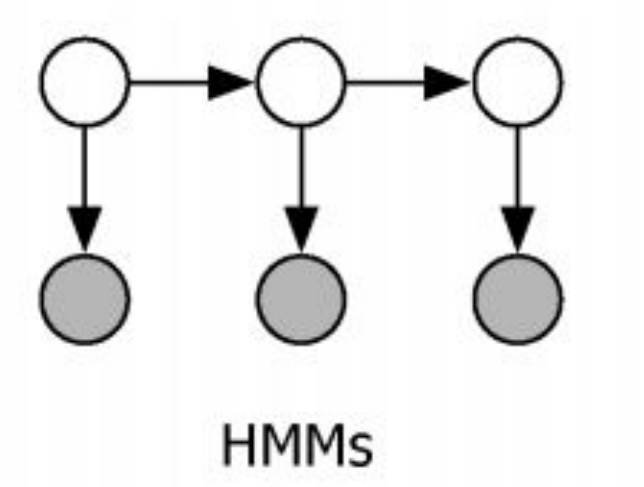
Hidden Markov Models

Jenny Copara

Definition

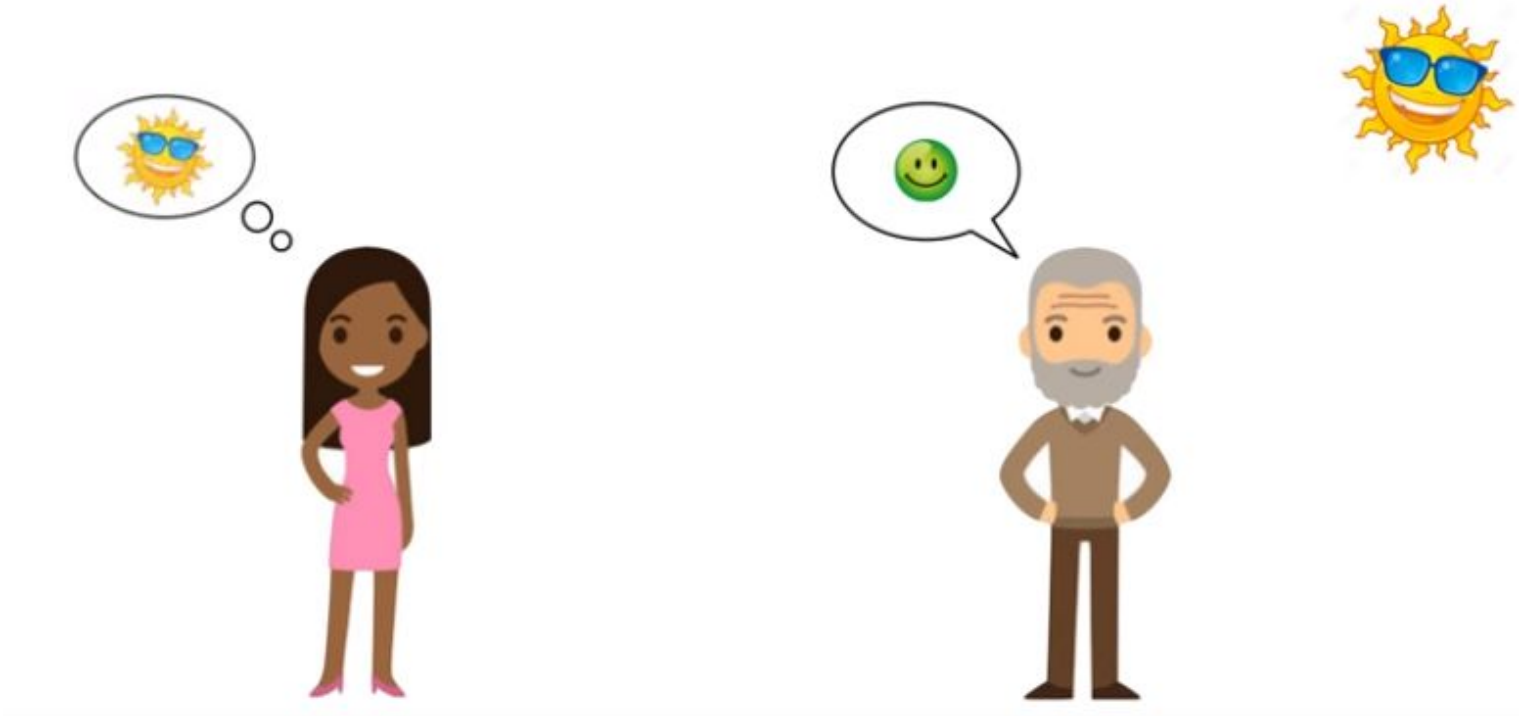
HMMs are tool for modelling time series data.



Definition

$$p(x_1, ..., x_n, y_1, ..., y_{n+1}) = \prod_{i=1}^{n+1} q(y_i|y_{i-2}, y_{i-1}) \prod_{i=1}^{n} e(x_i|y_i)$$

Example - Weather



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Example - Weather

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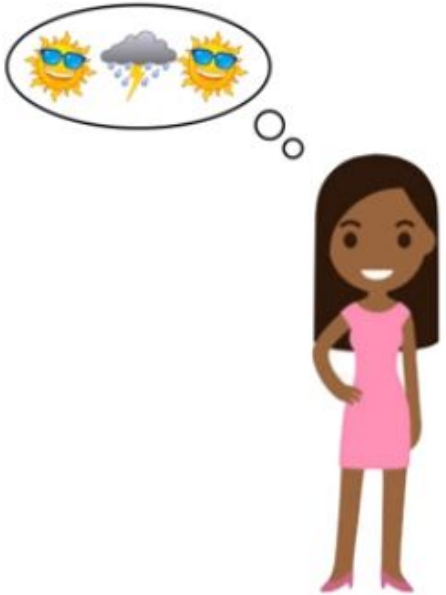

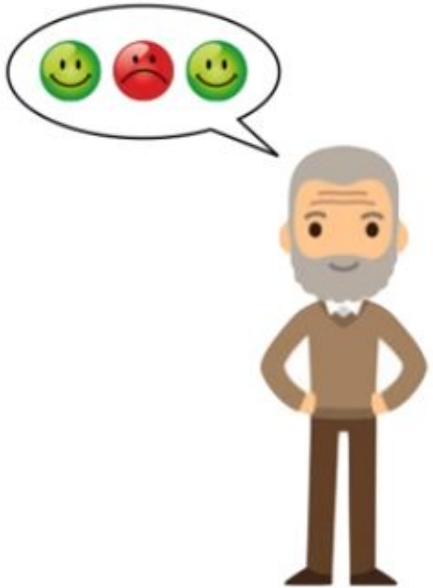

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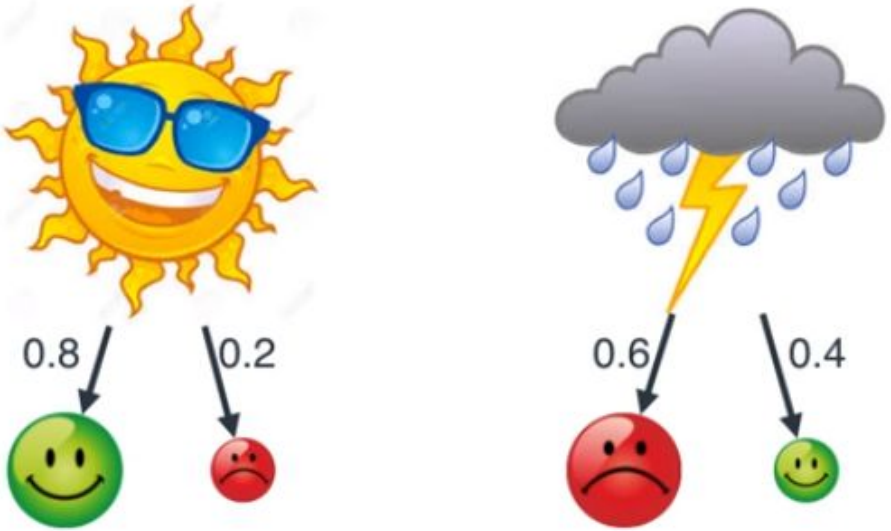

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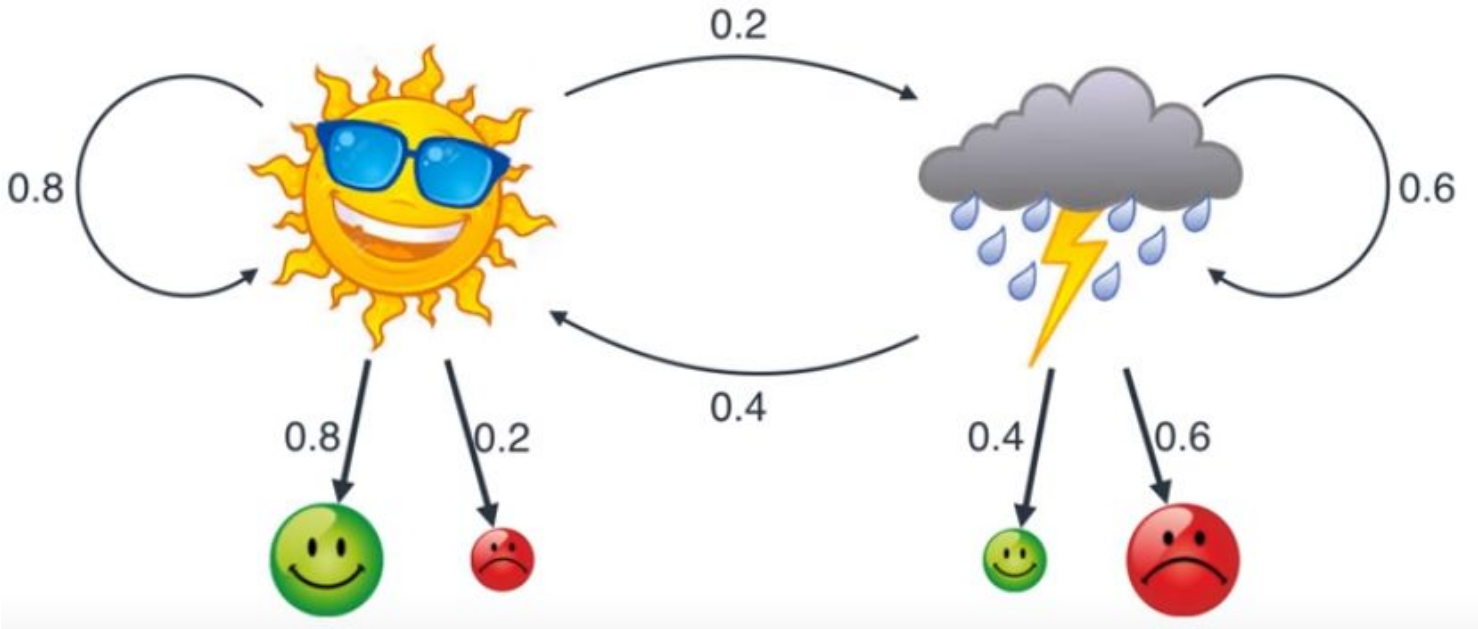

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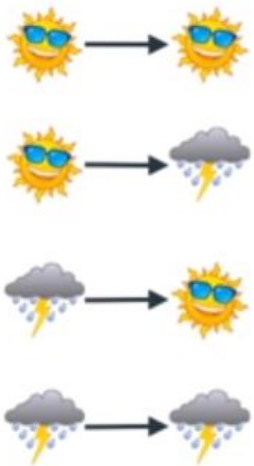

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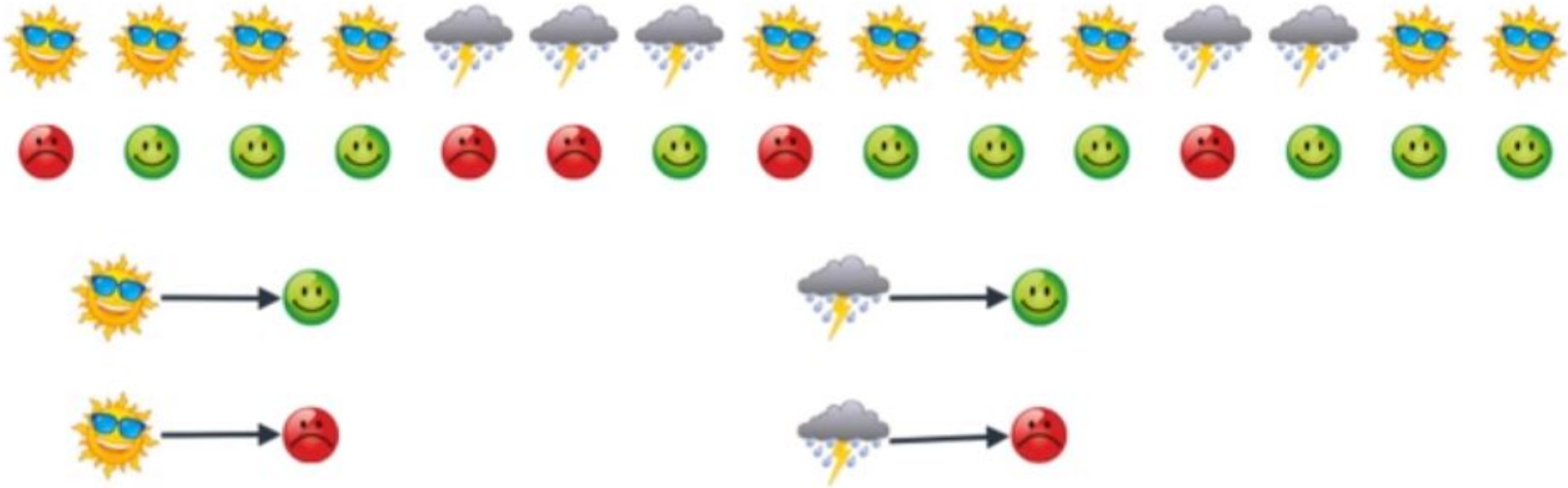

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Example - Weather

What's the weather today?

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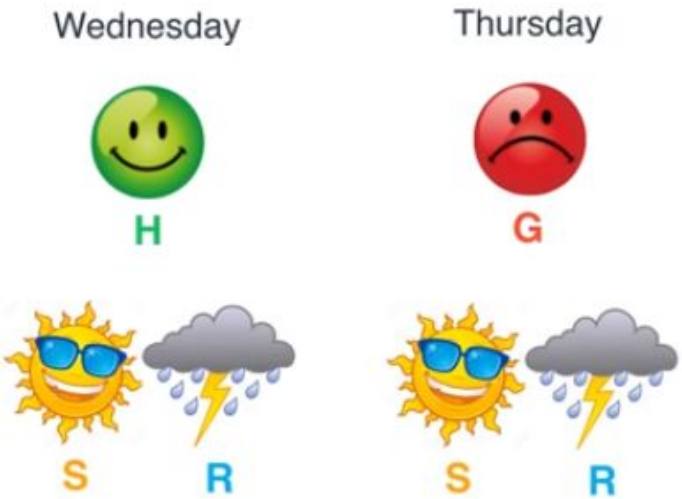
Example - Weather

If we know that Bob was Happy, Grumpy, Happy, what was the weather?

Example - Weather

If Bob was Happy-grumpy, what was the weather?



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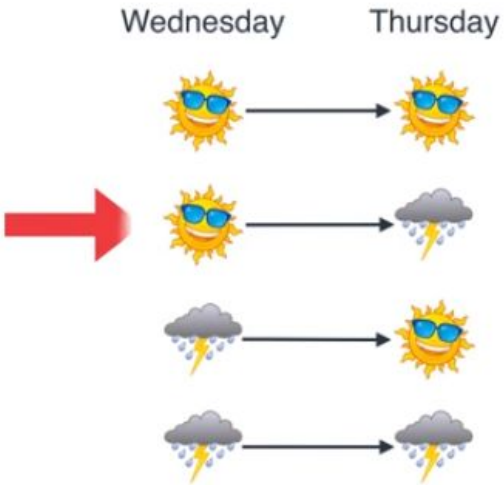

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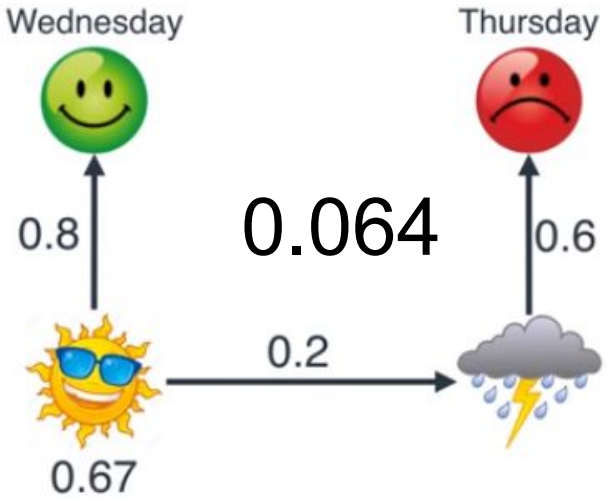

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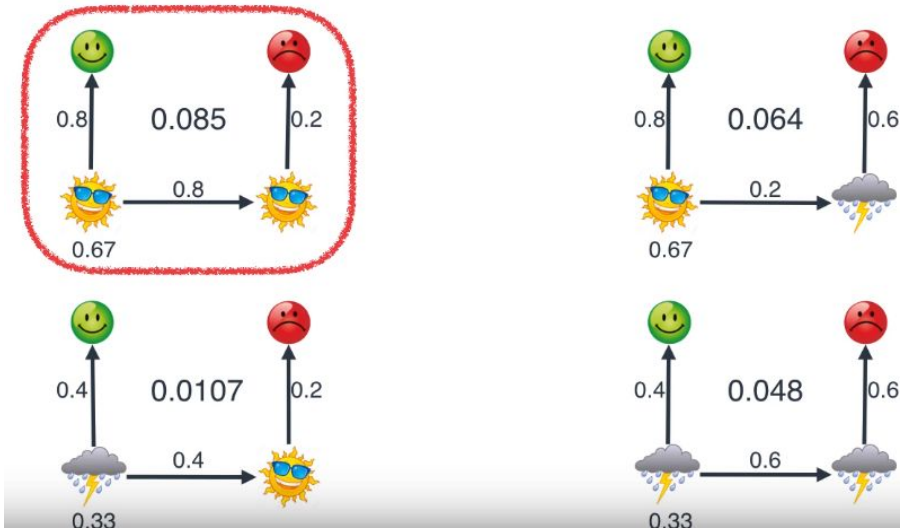

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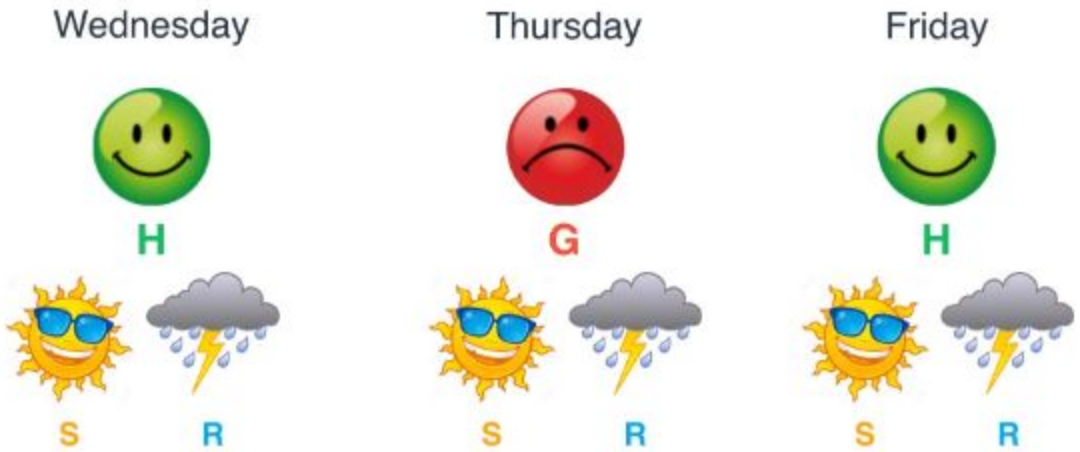

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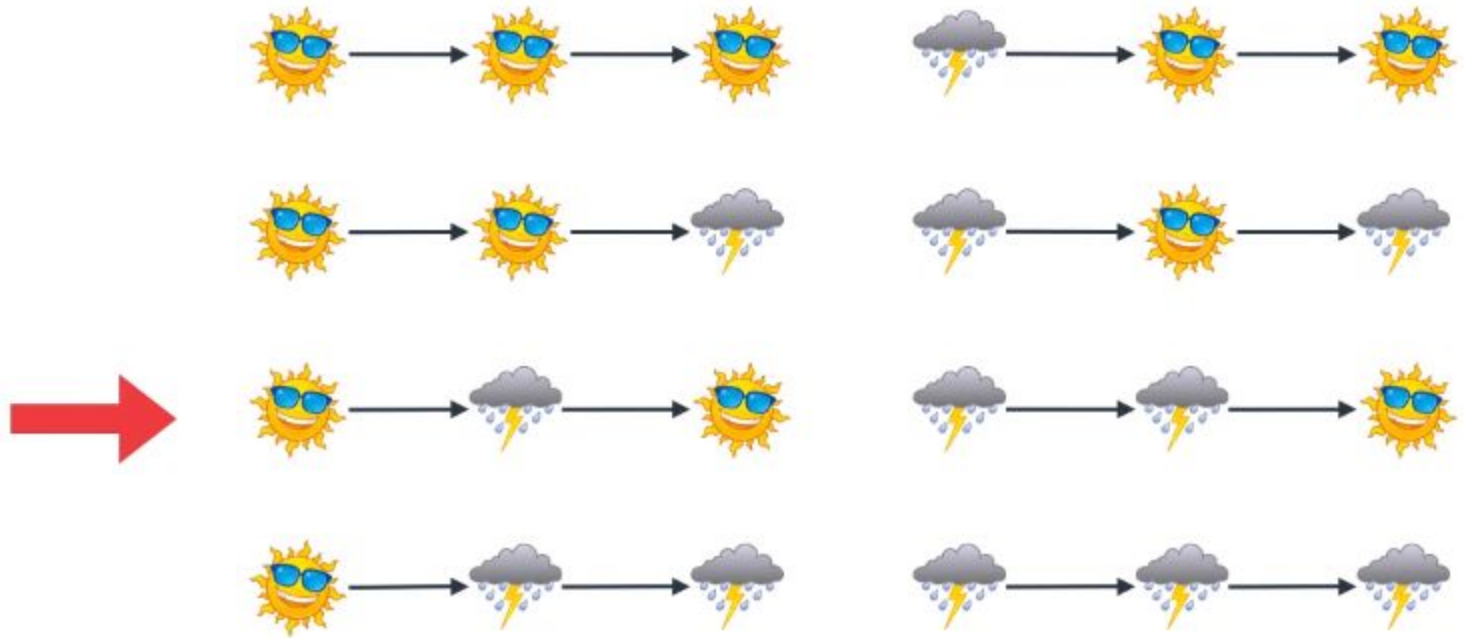

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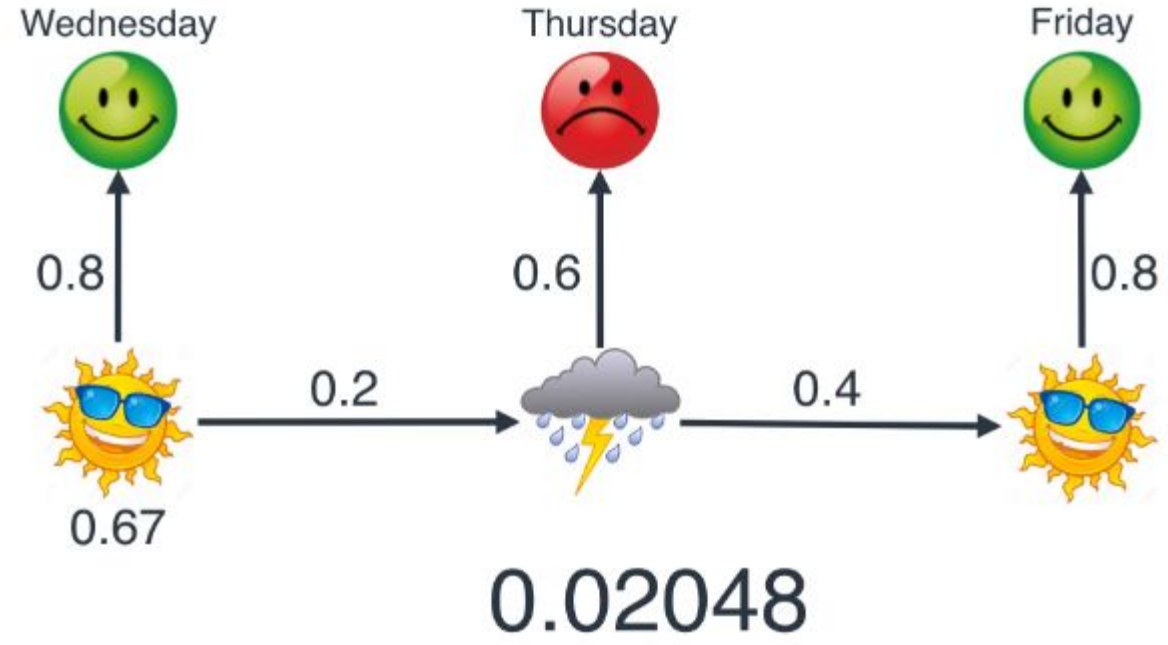

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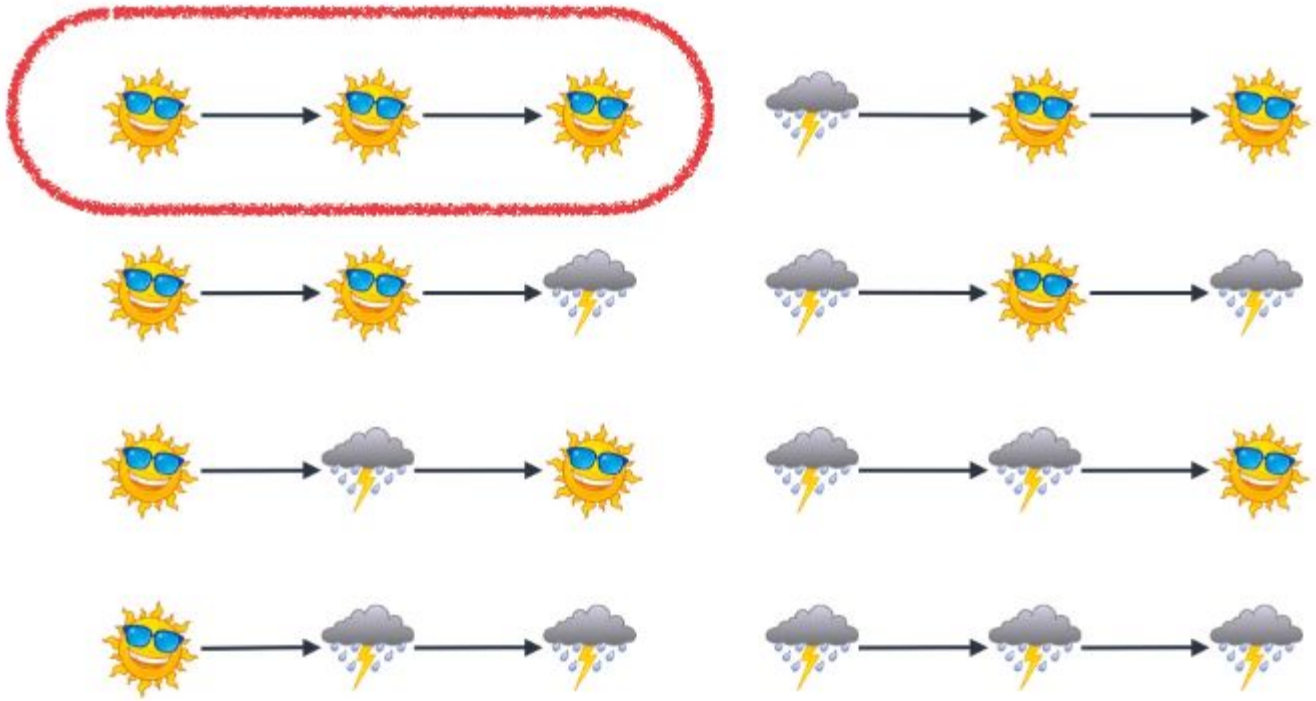

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HMM

Number of sequences is given by: $|S|^n$

|S|: number of elements in tag set, number of tags to be predicted

n: lenght of sequence to be predicted

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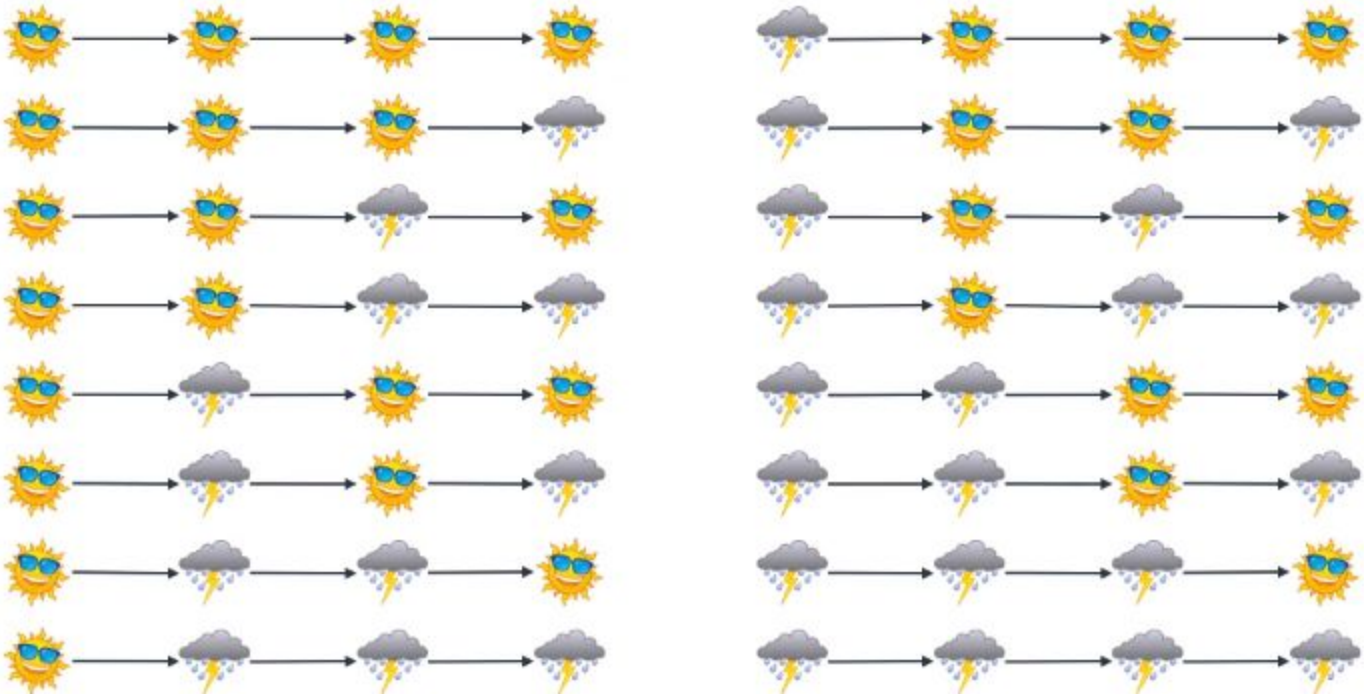

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Example - Weather

Viterbi algorithm

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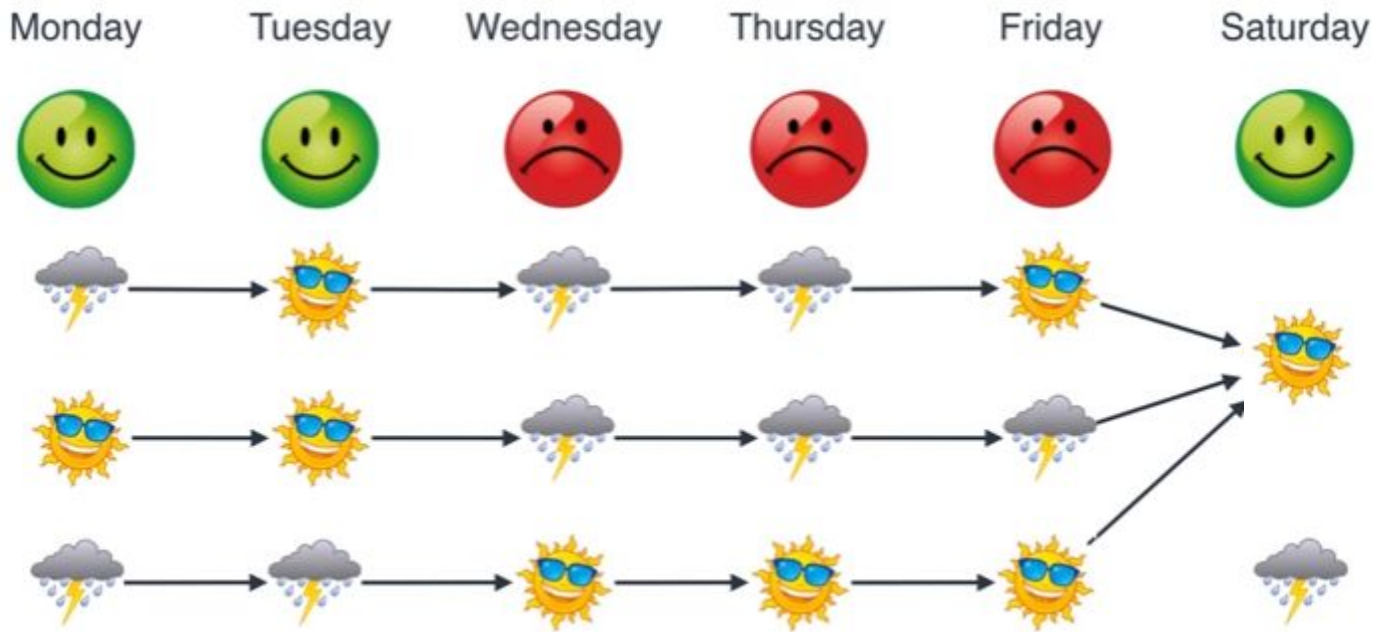

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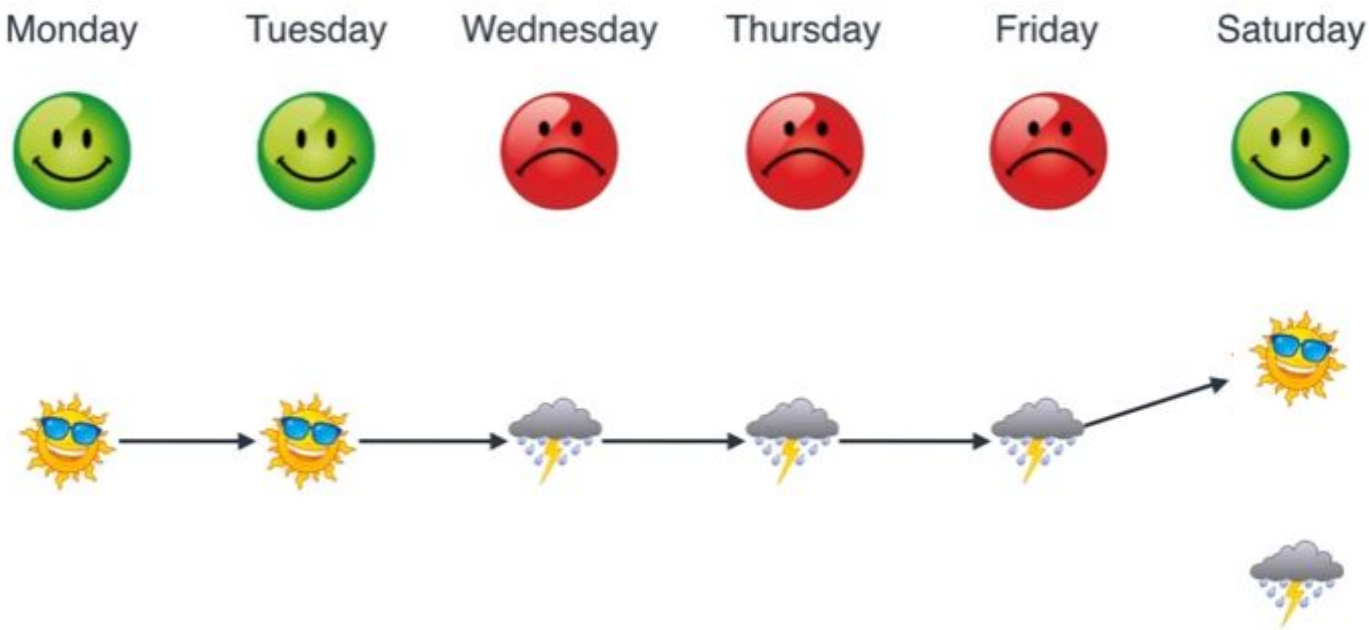

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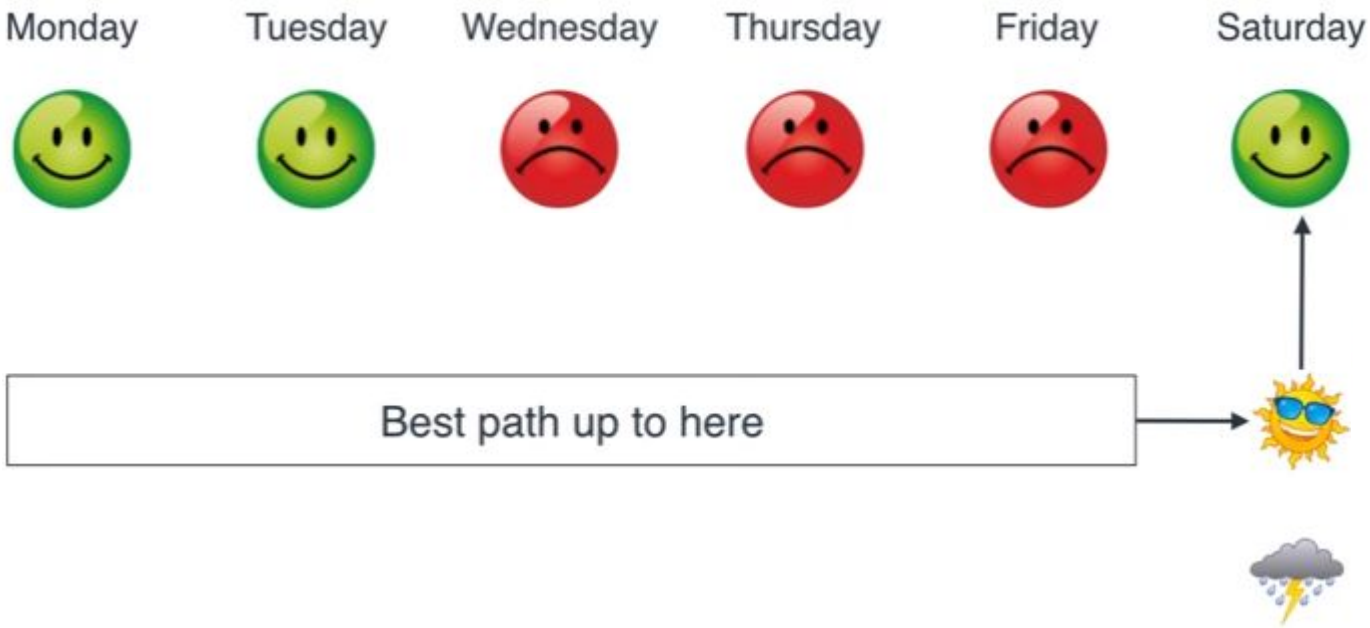

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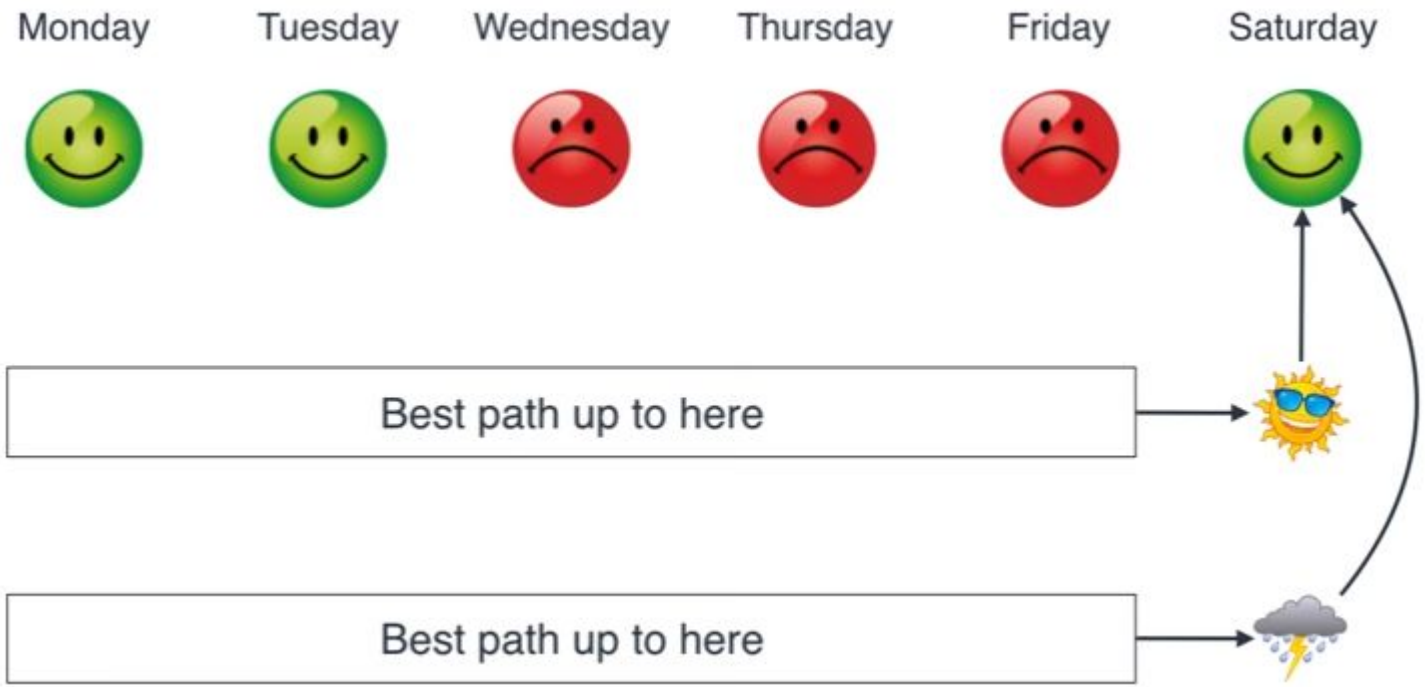

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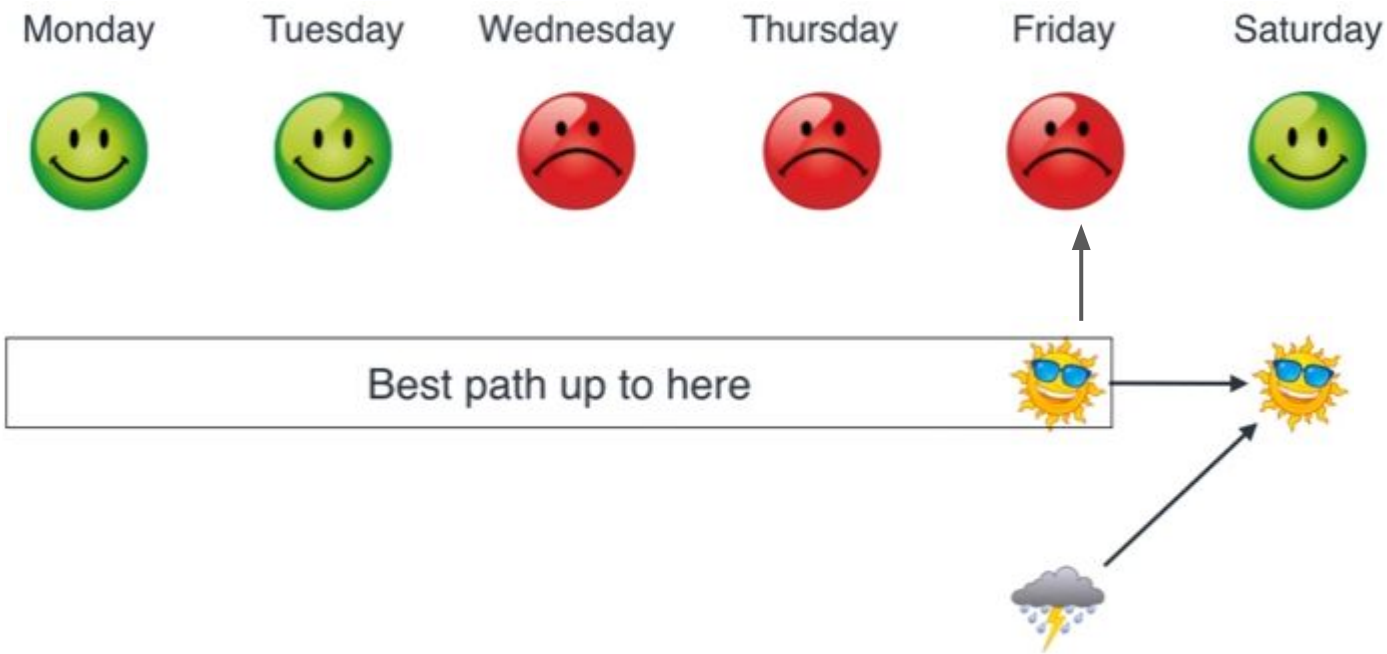

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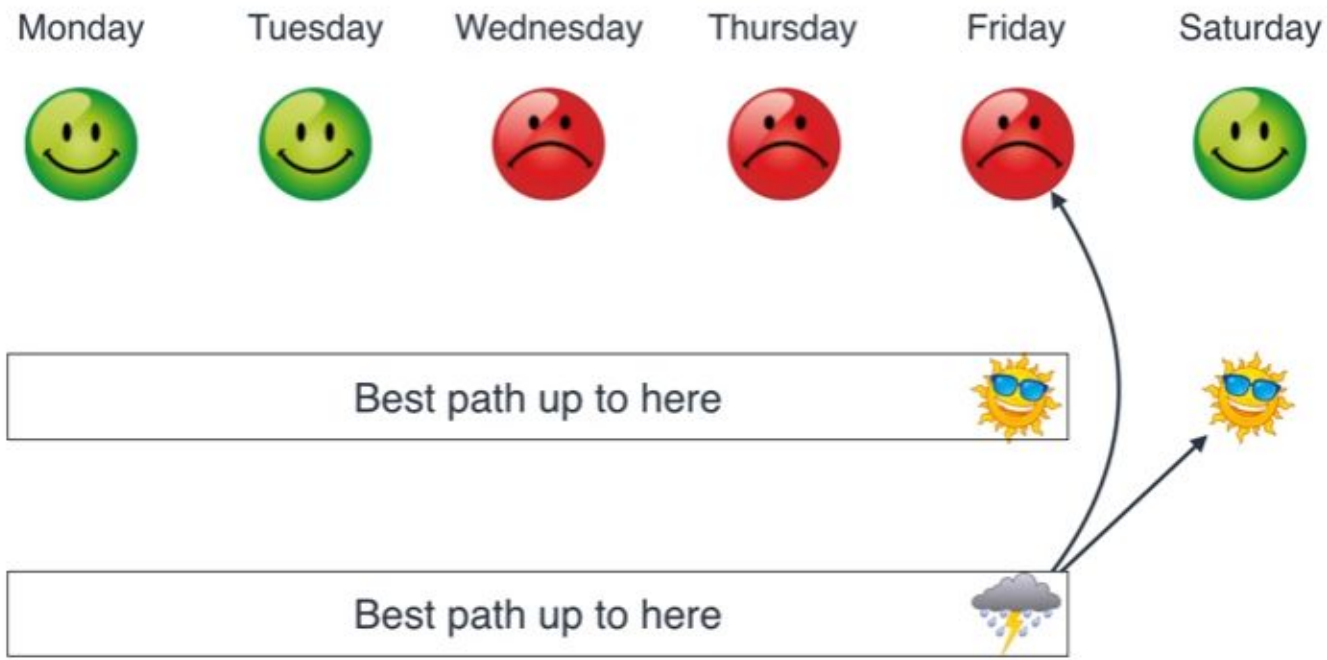

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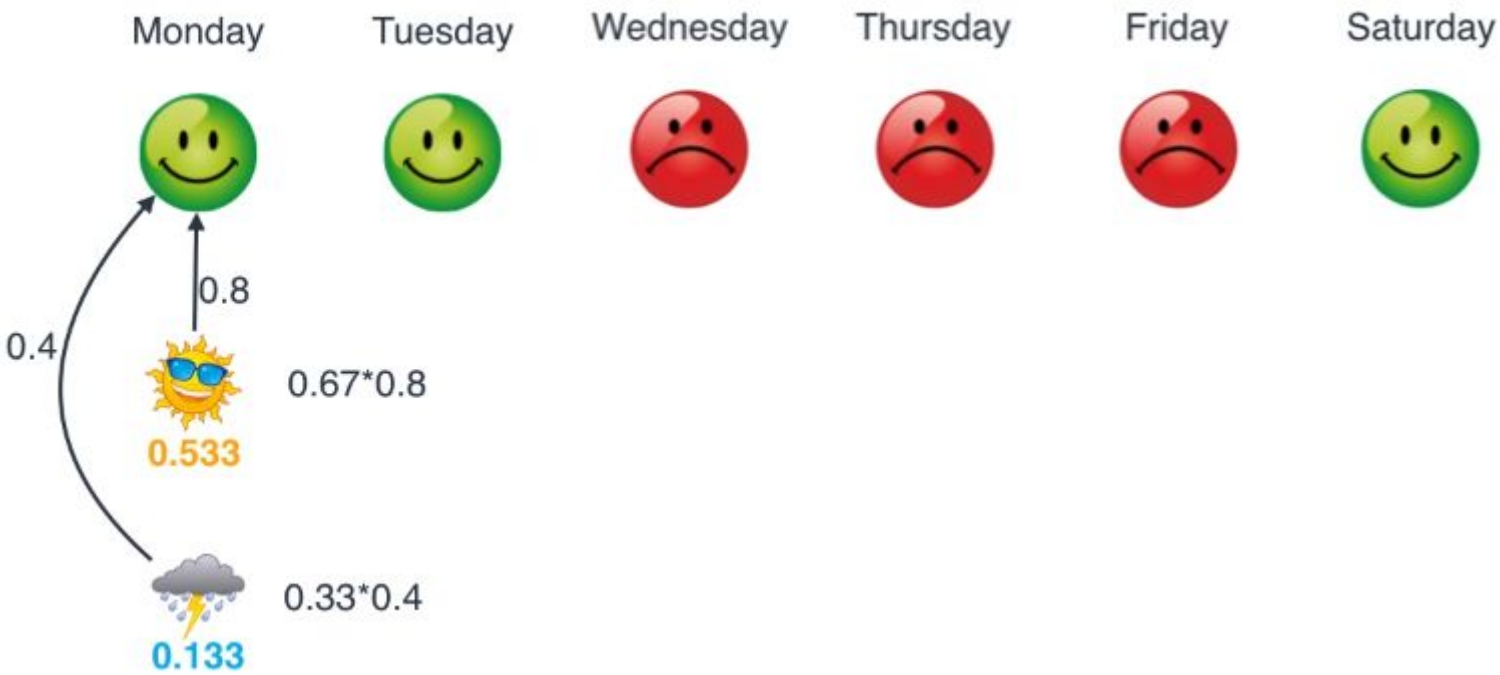

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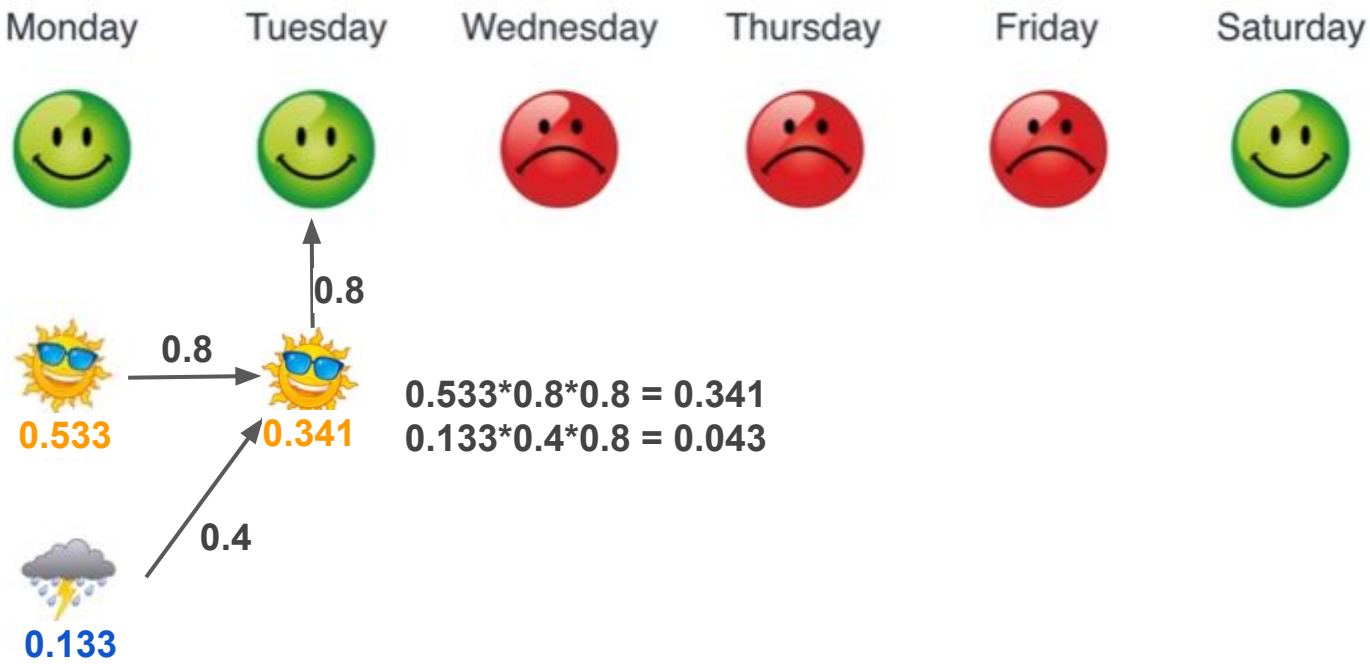

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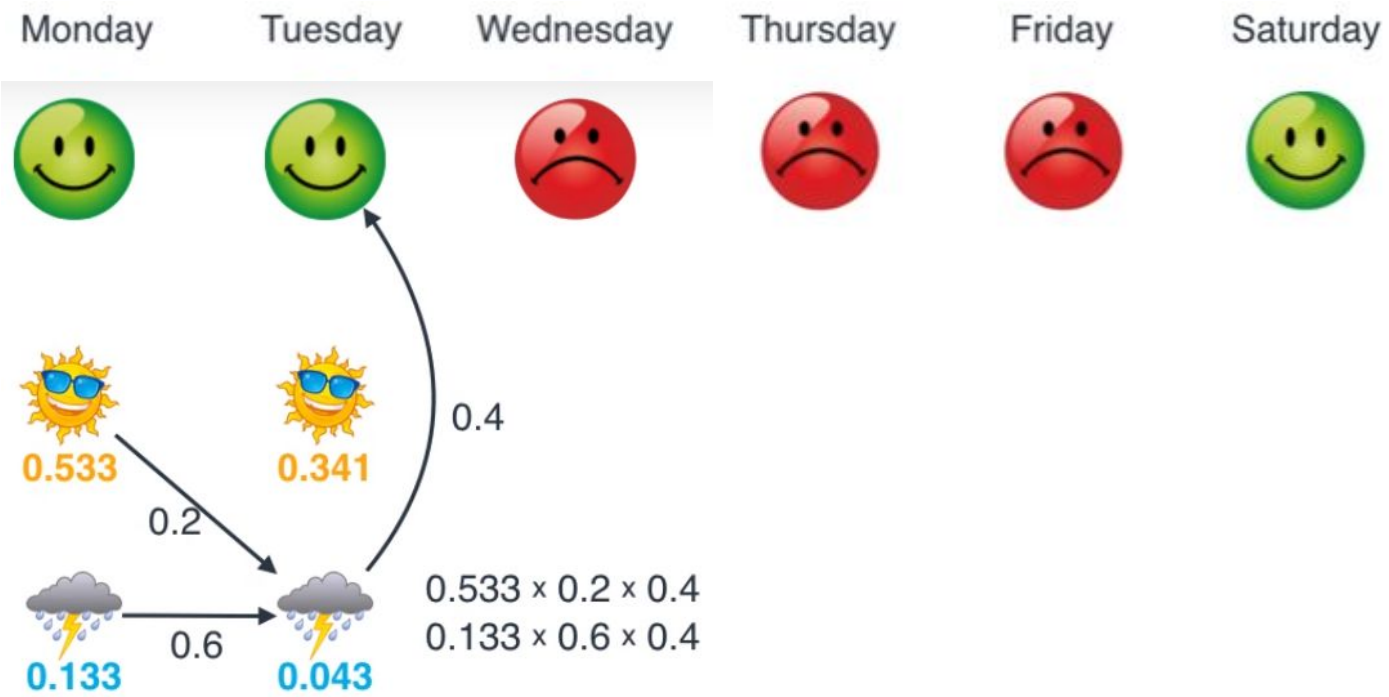

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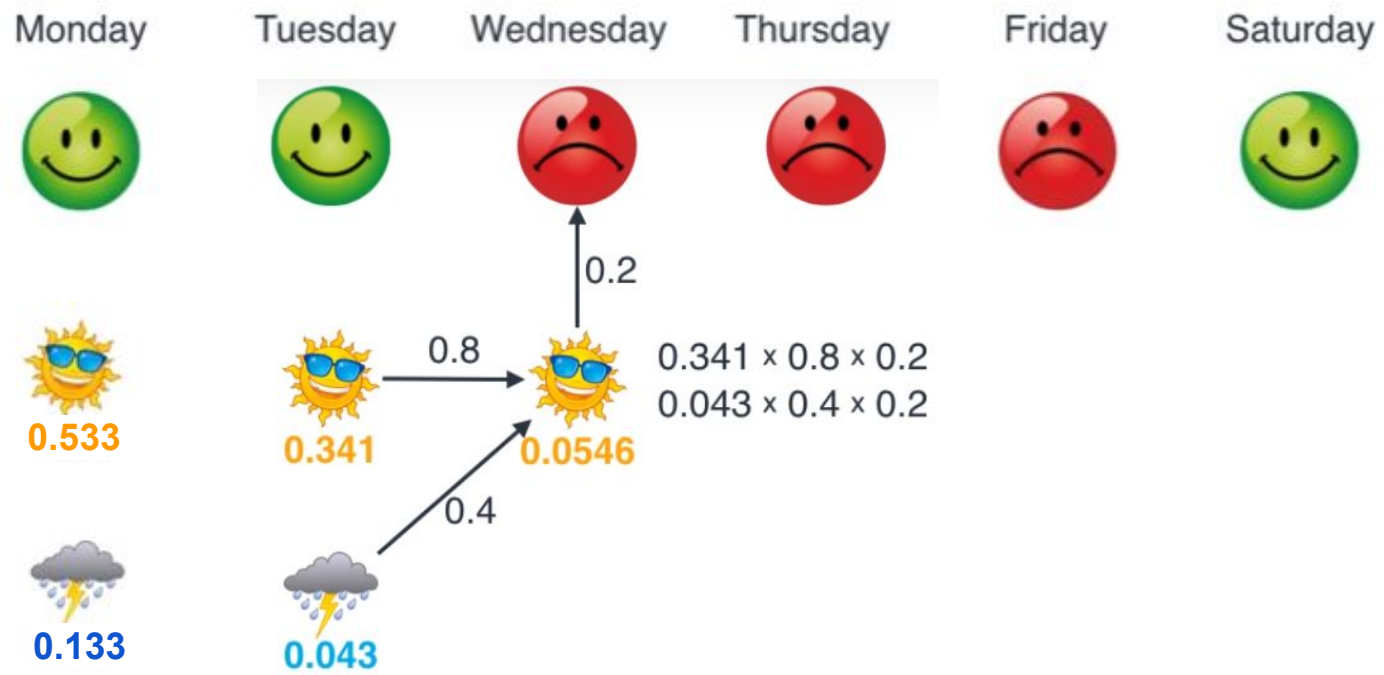

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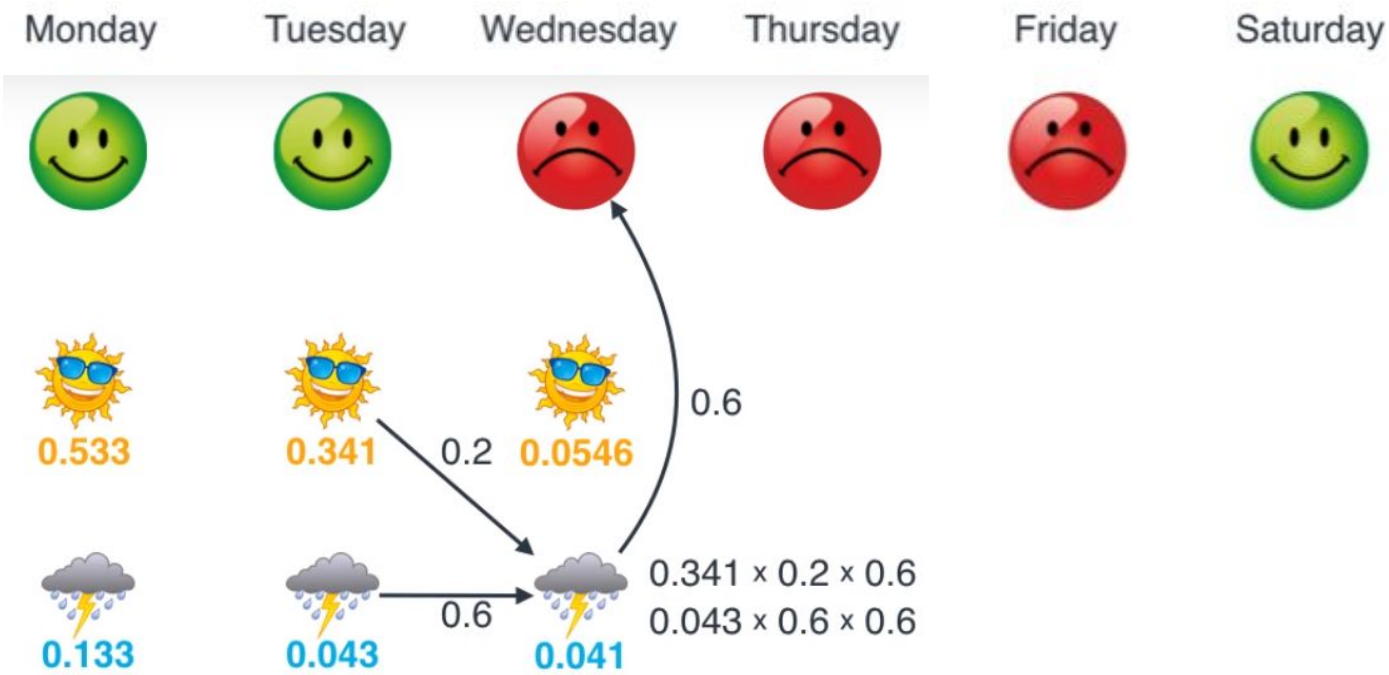

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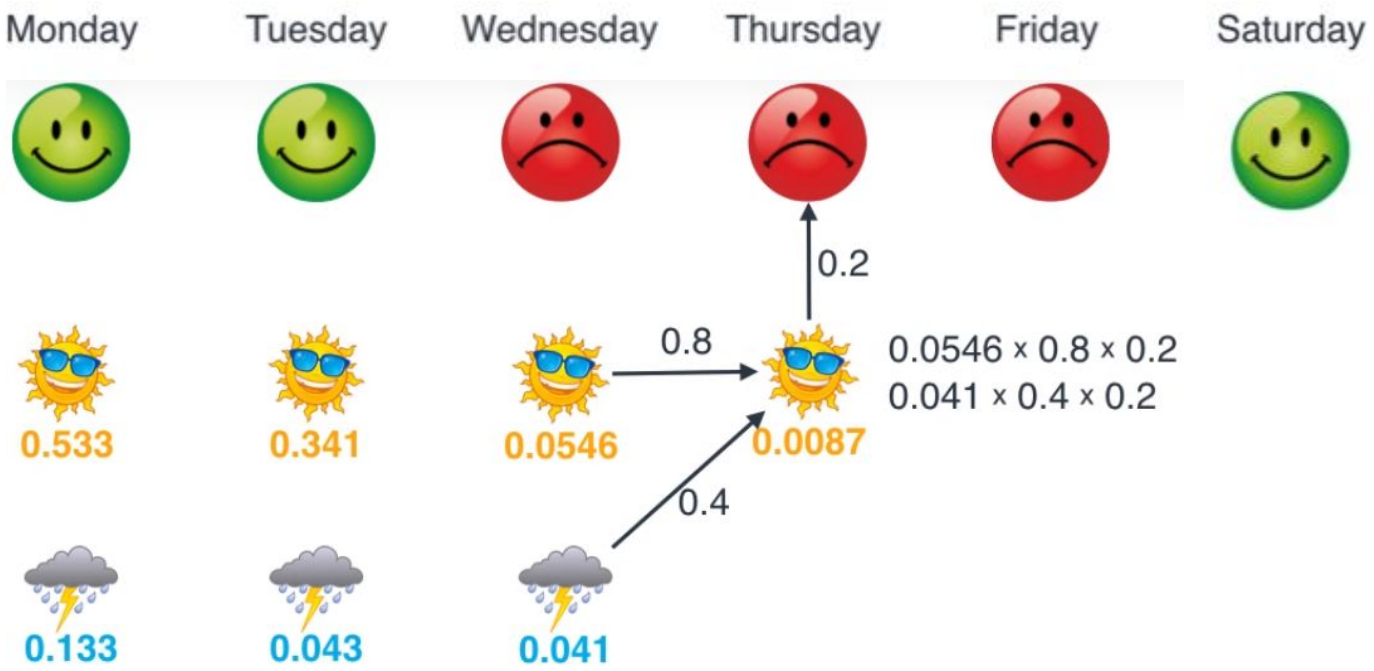

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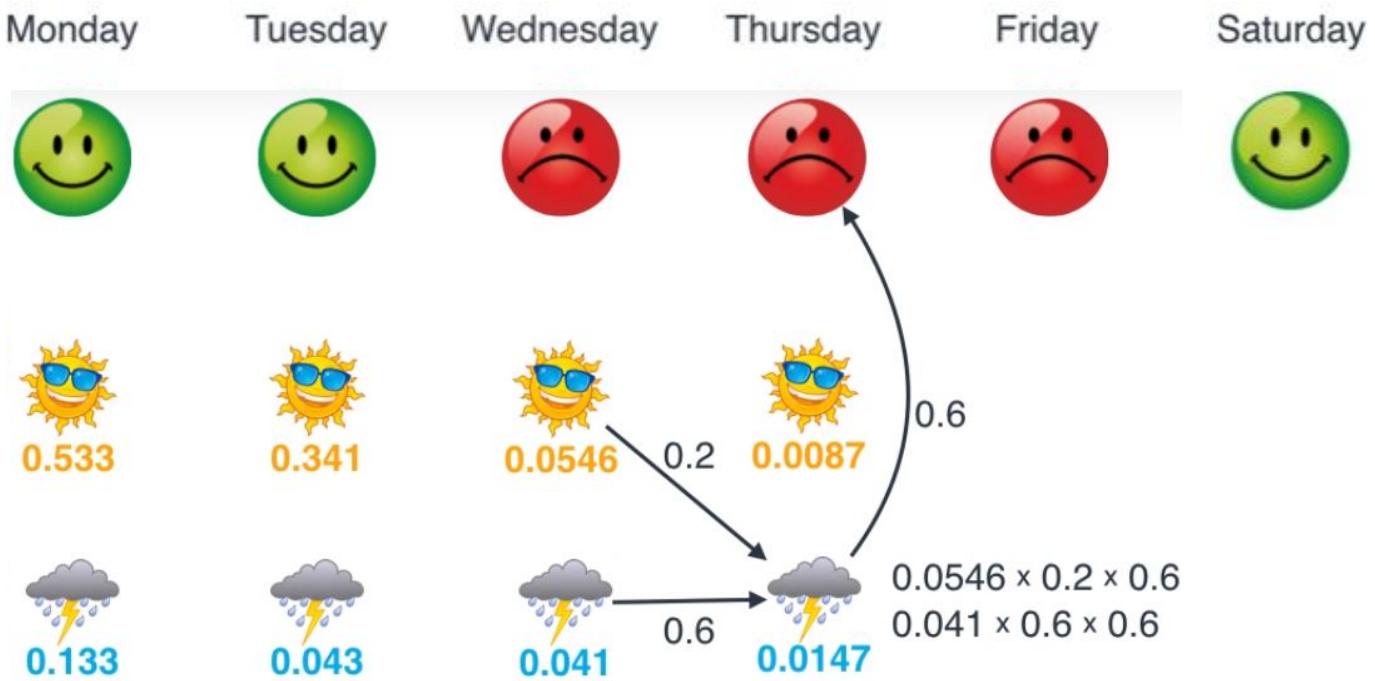

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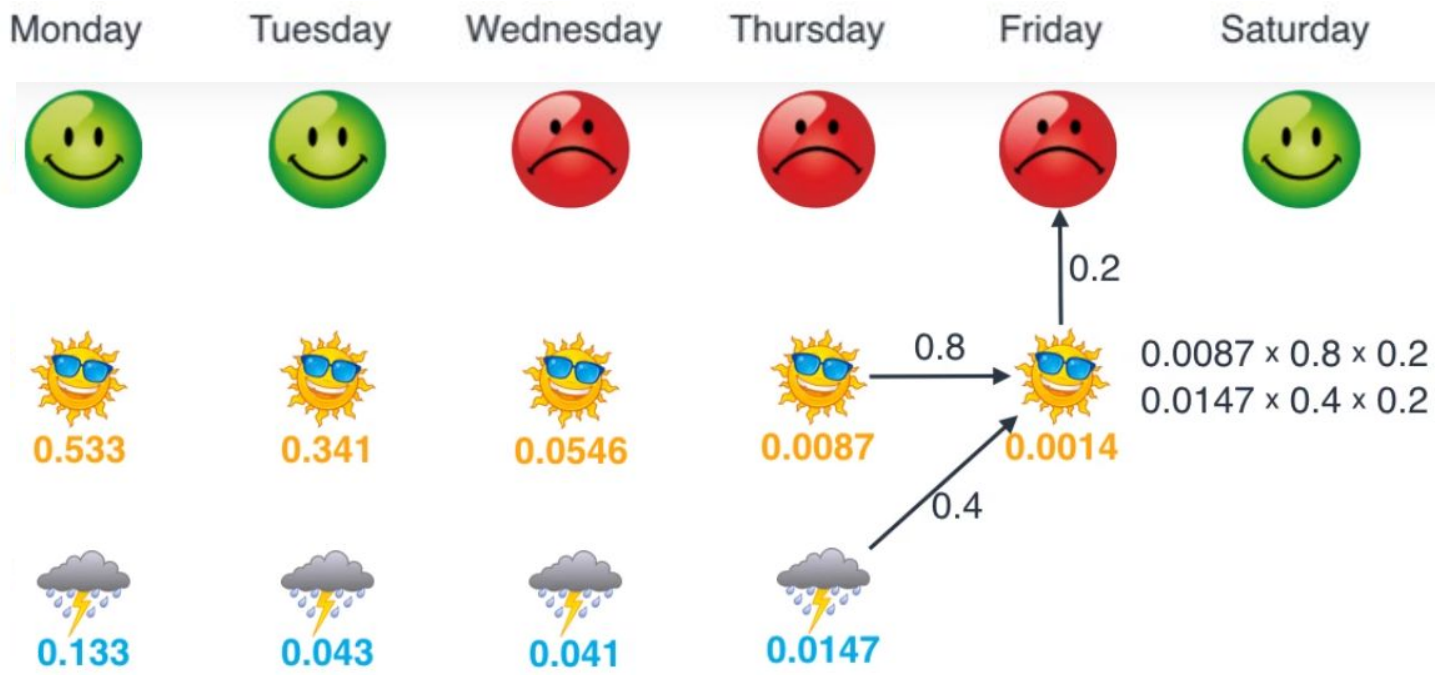

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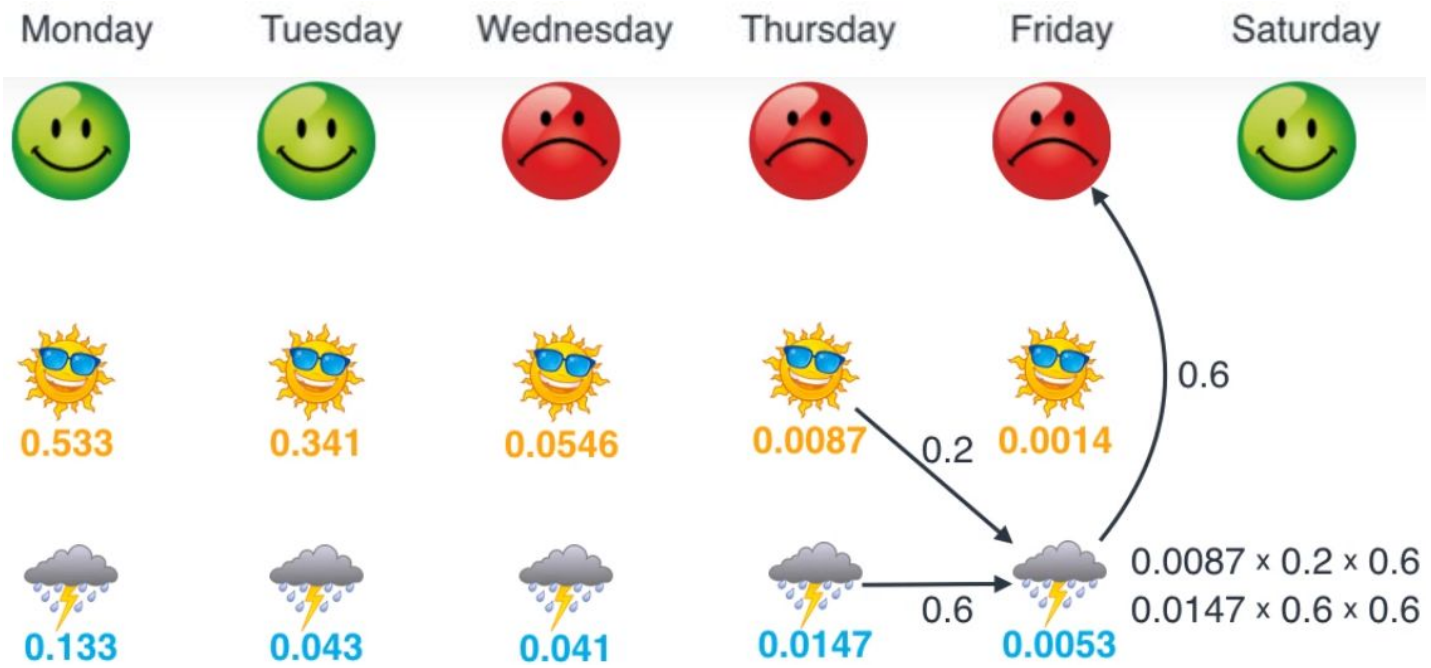

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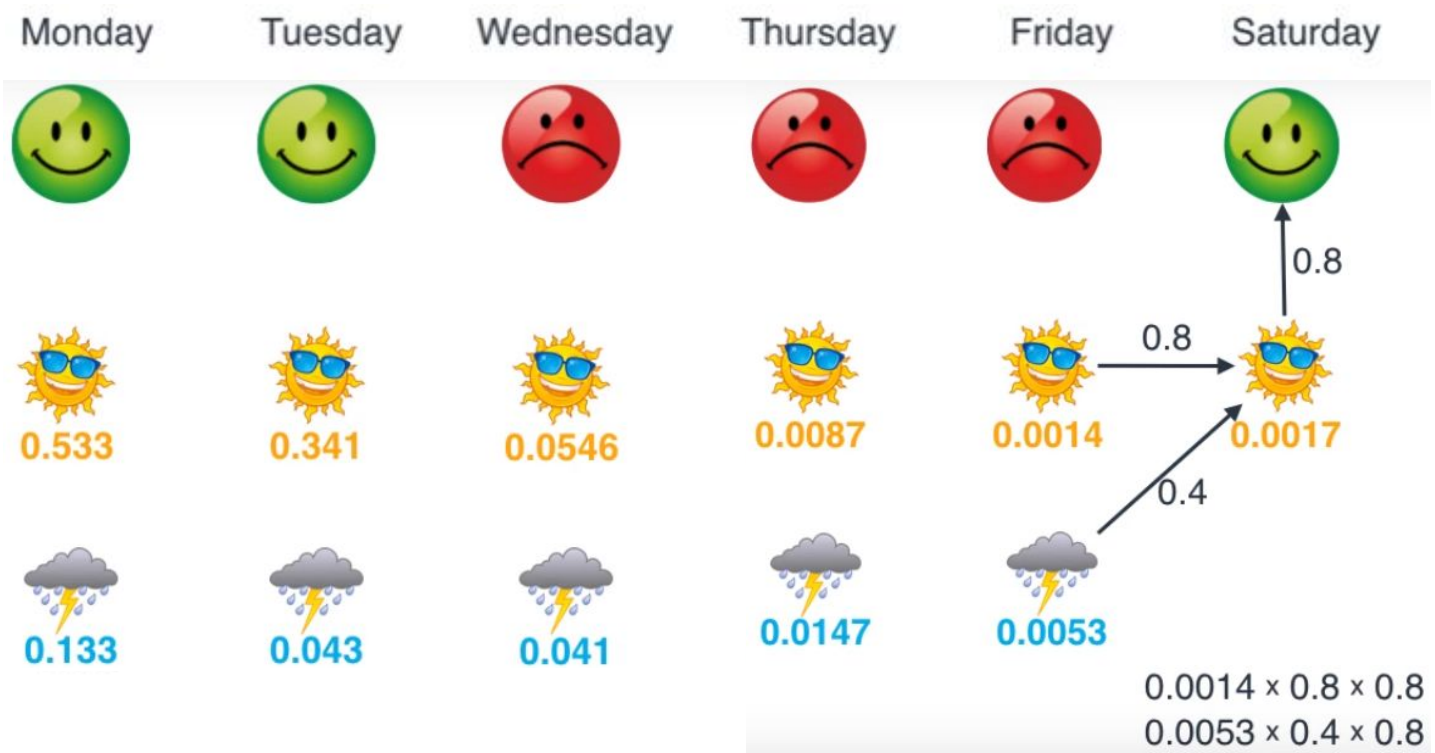

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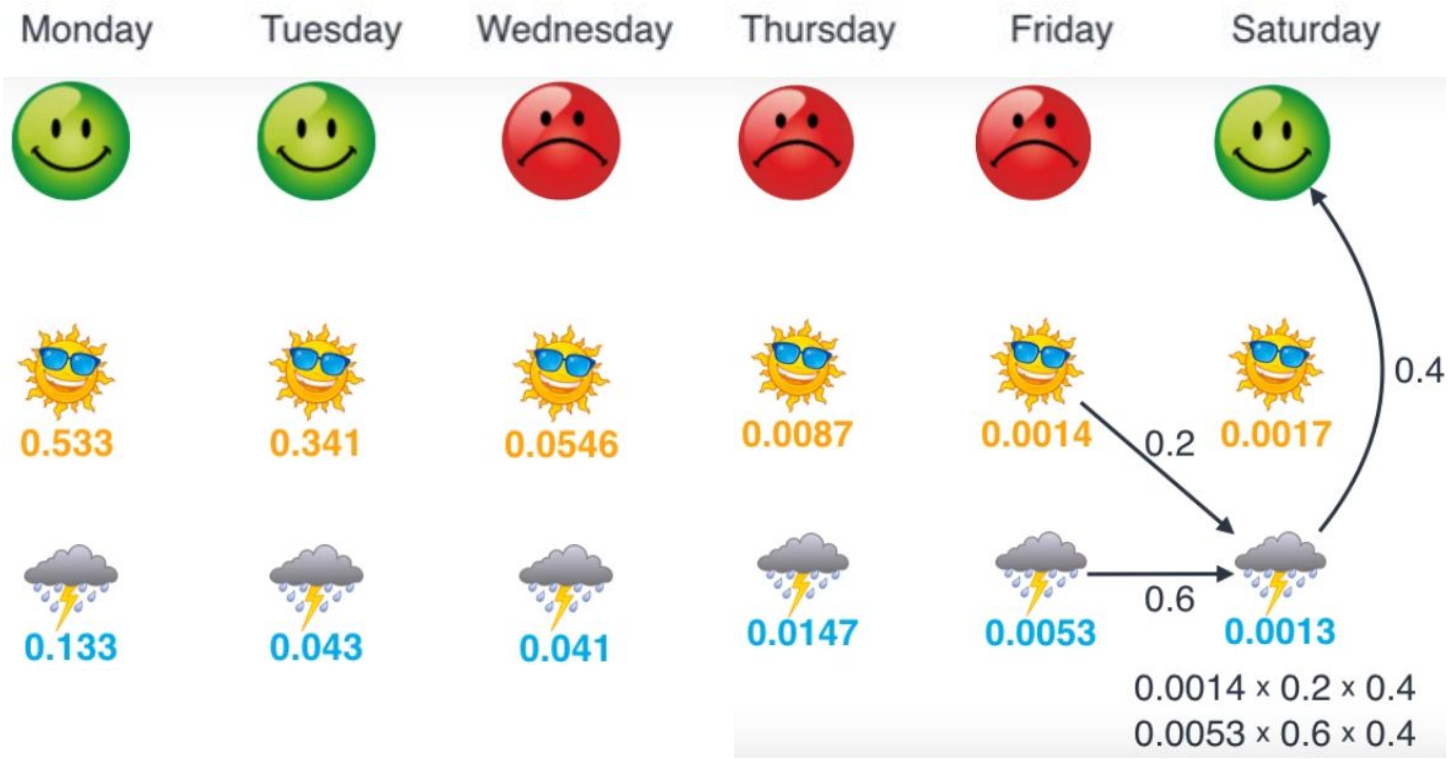

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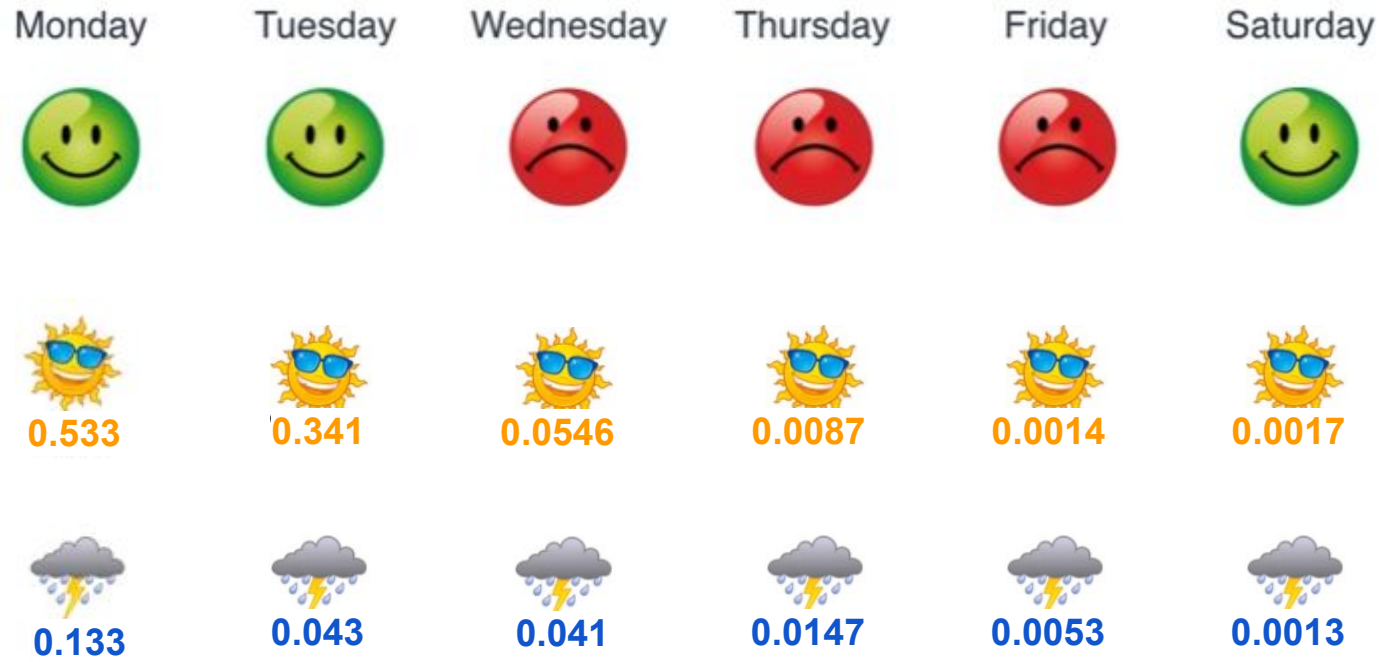

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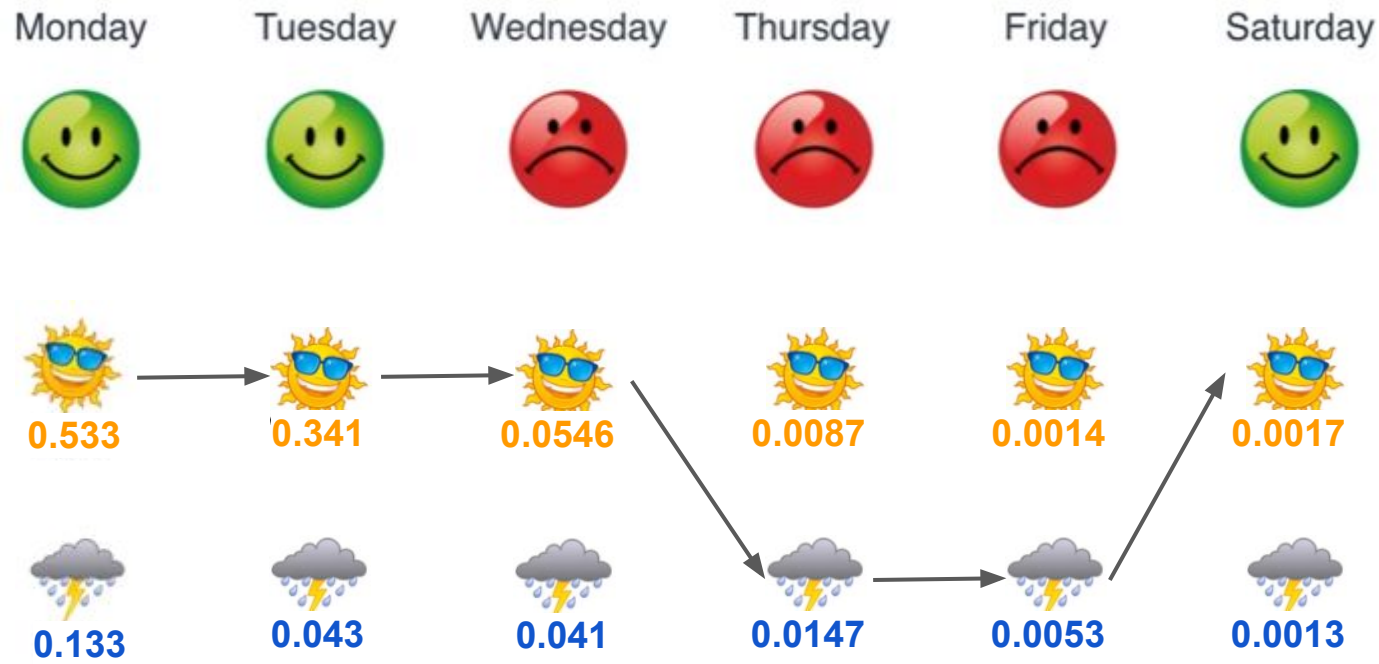

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Code
https://github.com/luisguiserrano/hmm/blob/master/Simple%20HMM.ipynb

Applications

1. PoS tagging, NER
2. Human identification
3. Face Expression Characterization
4. Genetics
5. Speech recognition

Libraries

Pomegranate:
https://pomegranate.readthedocs.io/en/latest/HiddenMarkovModel.html#hiddenmarkovmodel

HMMLearn:
https://hmmlearn.readthedocs.io/en/latest/tutorial.html#

GHMM Library: General HMM
http://ghmm.sourceforge.net/