Derivation of sum of output flow.

question posted 21 days ago by **gmikawa**

At 3:09 video clip in Lesson 3 week 4. May I ask you how you reduced the sum of output flow to π(i)q(ii)? Many thanks.

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1 response

laurent_decreusefond(Staff)
21 days ago

The flow from state i to state j is $\pi_i q_{ij}$. The output flow from state i is the sum over all over state j of the flow from i to j, that is to say $\sum_{j\neq i} \pi_i q_{ij} = \pi_i \sum_{j\neq i} q_{ij}$ but the very definition of q_{ii} is exactly $q_{ii} = -\sum_{j\neq i} q_{ij}$ so the output flow emanating from state i is $-\pi_i q_{ii}$ or $\pi_i |q_{ii}|$

hope this helps

That helps, Laurent. Thank you. This is going to be a taoutologic question, but why the sum of row i of transition rate matrix need to be zero? Was it explained somewhere?

posted 21 days ago by **gmikawa**

The sum is zero by construction: since we decided to set $q_{ii} = -\sum_{j \neq i} q_{ij}$

There is no intuitive signification to be searched for. The intuitive part is given by the p_{ij} (probability to jump from I to $j$when there is a jump) and λ_i, the parameter of the exponential which gives the sojourn time in state i. The construction of Q, the sum of the i-th row is

$$q_{ii} + \sum_{j \neq i} q_{ij} = 0$$

comes from more complex mathematical results which are beyond the scope of this course. By the way, this construction takes a lot of time to be given, needs more sophisticated prerequisites and is useless when it comes to use CTMC in practice.

posted 18 days ago by**laurent_decreusefond**(Staff)

When you are given a system you want to represent by a CTMC, compute the p_{ij} and the λ_i from the description of your model and then transform them in the q_{ij}, which are the mathematical quantities of interest.

$$q_{ij} = p_{ij}\lambda_i, \quad q_{ii} = -\lambda_i$$

and in the reverse way

$$p_{ij} = \frac{q_{ij}}{|q_{ii}|}, \quad \lambda_i = |q_{ii}|$$

posted 18 days ago by**laurent_decreusefond**(Staff)

Thank you, Laurent.

posted 18 days ago by**gmikawa**

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