Probability hackathon BM2033

Akhil Gattu(BM20BTECH11001)

Placement of vans

- In the first step, we have our random variables to be X, Y at different snapshots of time.
- At a particular time, we plot a 3D histogram of X and Y with Z-axis being frequency.
- We now get 3D histograms for different times which shows that the distribution of people changes with time. From frequency of 3D histograms, we get joint pdf of X and Y.
- The joint pdf of X and Y is a multimodal Gaussian, that is, it is a combination of different Gaussians.
- As the density functions of coordinates change with time, the advertising van needs to move(it is dynamic) to maximize footfall.

Placement of vans(contd.)

- We need to place the advertising van such that it is visible to maximum number of people.
- Hence, we can place the van at a point where the density of finding people is the highest if the point is at road.
- Let (u, v) be coordinates of a point not on road having the highest density. We place the van at the coordinate $E[(|x-u|)|u]$.
- If $E[(|x-u|)|u] > 5$*sigma of Gaussian with mean at u, we move to the point having the next highest frequency and repeat the above 2 steps(Let sigma^2 be the variance of Gaussian with mean at u).
- We can place the pharmacy van near the hospital as people visiting the hospital would buy them. The pharmacy van is static and need not move.
- We can make the orthopaedic/paediatric van follow the advertising van except the hospital.

Movement of vans

- After placing the advertising van at some coordinate, we decide its movement.
- As the density functions at a particular coordinate change with time, we observe the number of times the van passes a particular coordinate.
- Since we are dealing with atomic events, we can model the movement of the advertising van based on a Poisson process.
- We can calculate the number of times the van crossed a particular time in times: 1,2,3,4,5,..
- We can count the number of people at distances v*t from the point of consideration and get N1,N2,N3,... where Nt is poisson random process at time t as v is speed of van.
- As we have N1, N2, N3, N4,... we can estimate the lambda parameter or rate of arrival of poisson using maximum likelihood expectation(N1,N2-N1,N3-N2 are independent so lambda = [N1+(N2-N1)+...(Nn-Nn-1)]/n = Nn/n).
- Greater value of lambda depicts greater probability of finding a particular number of people.

Back-up slide-1

Histogram plot