Assignment 10

Machine Learning COMS 4771

Spring 2014, Itsik Pe'er

Assigned: April 14th   Due: Wednesday, April 23rd 1:10pm

Submission: Your submission folder on Courseworks. Submit folders for
`Assignment10.Problem01`, `Assignment10.Problem02` and `Assignment10.Problem03`

Chessboard City has 64 rectangular blocks arranged in an 8x8 grid, bounded from the south by Machine St., and from the west by Learning Ave. The rest of the streets are numbered from south to north by numbers 1..8, and avenues from west to east by letters a-h. Each block is named a1..h8 after the corner northeast of it. You are in charge of public health in the city and are concerned regarding an airborne epidemic that spreads easily from block to an adjacent block or diagonally adjacent block by the south and west winds. Specifically, each city block may either be contaminated or not, and it has a (potentially empty) set of size ≤ 3 blocks that can infect it: an adjacent block to its south (unless it faces Main St.), an adjacent block to its west (unless it faces Learning Ave.) and a diagonally-adjacent block to its southwest (if it faces neither Main St. nor Learning Ave.). Each block x has a 5% chance to be spontaneously contaminated, i.e. even if x has no contaminated blocks that can infect it. However, each such potentially infecting neighbor block that is contaminated additively increases the chance of x being infected by 30 percentage points.

1) Draw the Bayes Net for the joint distribution of contaminated blocks across Chessboard City, and write the conditional probability tables [20pt]
2) Install Bayes Net Toolbox https://github.com/bayesnet/bnt and write a function
   `ChessboardCity = MakeChessboardCity()` that returns a `bnet` object implementing the ChessboardCity joint distribution of blocks being contaminated (value of 2) or not (value of 1). The variables should be named 'a1', 'a2', …'a8','b1',…,'b8',…,'h8'. [30pt]
3) City Hall is located in blocks c5,d5 and City Hall Neighborhood contains these two blocks along with the 6 blocks that are adjacent to them. You have verified that neither City Hall Neighborhood nor any of the 10 blocks adjacent to it are contaminated.
   a) What blocks depend on a1? Explain. [15 pt]
   b) If you know g7, what blocks depend on a1? Explain. [15pt]

Good luck!