Weekly report of lessons

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The topics covered : Bayes Estimator ,Parametric Classification,Multivariate Representation , Multivariate Normal Distribution , Nonparametric Classification ,Univariate density estimation,k-NN Estimator ,Instance based learning,k-NN regressor , LWR

Summary topic wise:

- Bayesian estimation is to formulate a prior distribution, $\pi(\theta),\ on\ \theta$. This prior distribution allows us to compute $P(\theta / A)$ for any set A. If assumed narrow prior distribution of $P(\theta / A)$, using MAP estimate of θ we get $\theta_{MAP} = argmax\, P(\theta/A)$. The best estimate of a random variable is its mean.
- Bayesian estimate of the mean of a Normal distribution with known standard deviation. By assigning an Uniform prior for m and use a Normal likelihood function for the observed n measurements x^i . No prior is needed for s since it is known and we arrive at a posterior distribution for m given by: $f(\mu) = \frac{1}{(2\pi\sigma^2)^{n/2}} exp(-\frac{1}{2\sigma^2}\sum_{i=1}^{n}(x_i-\mu)^2)$
- A model can be formed from a small number of parameters e.g., mean & variance .Estimate parameters from the sample to get an estimated distribution ,then use that distribution to make decisions .Classification discriminant function $g_i(x) = P(C_i)P(x|C_i) = logP(x/C_i) + logp(C_i)$. $P(x/C_i)$ can be assumed as gaussian too
- Multivariate Representation is analysis of multiple measurements, made on one or several samples of individuals .If we take several such measurements, we record them in a rectangular array of numbers.The set of observations, measuring variables, can be described by its mean vector $\mu = [\mu_1,\ \mu_{2\ldots}]$ and variance-covariance matrix $\rho_{ij} = \sigma_{ij}/\ \sigma_i\sigma_j$
- The multivariate normal distribution model extends the univariate normal distribution model to fit vector observations. Multivariate normal distribution if its density function f(X) is of the form : $f(X) = \left(\frac{1}{2\pi}\right)^{p/2}|\sum|^{1/2} exp\left[-\frac{1}{2}(X-m)'\sum^{-1}(X-m)\right]$. If all features are independent , covariance matrix is diagonal, i.e only $\sigma_i's$ classes are non zero.
- Nonparametric methods seek to best fit the training data in constructing the mapping function, whilst maintaining some ability to generalize to unseen data . The method does not assume anything about the form of the mapping function other than patterns that are close are likely to have a similar output variable.
- In univariate density estimation we create a histogram of the observations in the random sample. A histogram is a plot that involves first grouping the observations into bins and counting the number of events that fall into each bin. The counts, or frequencies of observations, in each bin are then plotted as a bar graph with the bins on the x-axis and the frequency on the y-axis.
- The k-nearest neighbour kernel density estimation method is a special type of the kernel density estimation method with the local choice of the bandwidth.An adaptive kernel estimator is given by: $\frac{1}{nr_n}\sum_{i=1}^{n} K\frac{(x-x^t)}{r_n}$ .Where r_n is a Euclidean distance between x and the kth nearest neighbour of x among x_i
- Instance-based learning are the systems that learn the training examples by heart and then generalizes to new instances based on some similarity measure. It has significant advantage over complex target function i.e computing function locally. This is also known as lazy learning .
- KNN regression is a non-parametric method that, in an intuitive manner, approximates the association between independent variables and the continuous outcome by averaging the observations in the same neighbourhood.
  For weighted average use weight inversely proportional to weight of the distances.
- Locally weighted regression (LWR) is a memory-based method that performs a regression around a point of interest using only training data that are 'local'' to that point.

Any novel idea of yours out of the lessons : Multivariate Statistical Analysis could be done with insurance sales prediction data that was given in assignment 2 to get a relationship among various features and responses for better sales.

The level of your preparation for the third quiz to be held on 3rd Nov. (Tuesday) at 8 PM: Satisfactory