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Report and Results

1.Introduction

In the data set Train_F.csv , we are provided with **countyname**, **countyfips**, **state_name** and **predicted_deaths** from october 6 to 12 and **severity_count**.Here we have to predict the **severity_count** (1 or 2 or 3) using a naive bayes classifier and assuming each feature is independent of the other.The column **countyname** and **countyfips** are mostly **unique** for all the samples, so it won't give much details about training. So, we are **dropping** it in the first place. Then we are encoding state_name from categorical to numerical value using Label Encoder

2.Algorithm Description

So, now we have a 2D matrix with all numerical values and we proceed for applying gaussian normal density function to calculate the probability
f(x) = the probability density
σ = standard deviation
μ = Mean of that feature
Bayes theorem states that, $P(A|B) = \frac{P(B|A)*P(A)}{P(B)}$

P(A|B): Posterior Probability

P(A) : Prior Probability

P(B|A): Likelihood

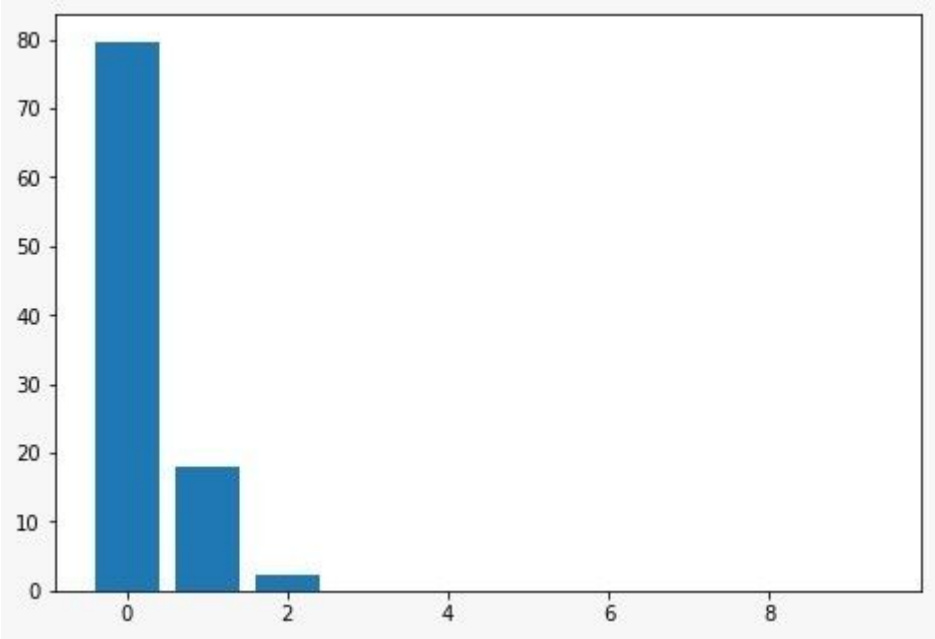
P(B) : Evidence
So, we get,

Posterior = Likelihood*Prior/Evidence
From the class and data point of view we say that
P(Class|Data) = (P(Data|Class)*P(Class))/P(Data)
So, for a instance <**x1,x2,...xn**>, probability of particular class **c** is **P(c|x1,x2,..xn) = P(x1|c)*P(x2|c)*...*P(xn|c)*P(c)**
Note: *We drop the denominator (the probability of observing the data in this instance) as it is a constant for all calculations.*
So, to predict the severity_count for a particular instance we will calculate for c=1 , c=2, c=3 and return prediction for which Maximum probability is received.
Here P(x1|c) is calculated by gaussian density function f(x) mentioned above.

Results:

With 5-fold cross-validation we obtained an **accuracy of 46.8%**
Principal Component Analysis:

Here we calculated the explained variance using eigenvalues of the standardized **covariance matrix.** The graph obtained between **Explained variance** action and **Principal Components** is as follows:



The plot above clearly shows that most of the variance (**79.7%** of the variance to be precise) can be explained by the first principal component alone. The second principal component still bears some information (**17.88%**) while the rest principal components can safely be dropped without losing too much information. Together, the first two principal components contain **96.95%** of the information.

With 5-fold cross-validation after PCA transformation, we obtained a
accuracy 28.08%

Sequential Backward Selection
Sequential Backward Selection we obtained the results as follows
Final Feature set obtained are:

- **0,3 and 4**