# Improving the Accuracy of Weather Forecasting Prediction on Data Cloud by Using Naive Bayes Classifier

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ABSTRACT--Weather Forecasting is a problem that can be predicted by using research. In this research, we use Naive Bayes Classifier to predict the weather on Data Cloud that we take from meteoblue.com and we tested it in Aceh, which are Bireuen and Gayo. The results shown that the accuracy of the prediction is about 89,47%. Keywords—Accuracy, Weather, Forecasting ,Prediction, Naive Bayes Classifier

# I. INTRODUCTION

Weather prediction is an activity to predict the condition of the Earth's atmosphere for the future with or without the help of technology. Humans have tried to make an accurate weather prediction, from the time of the ancient until now with technology and computer assistance. The main focus on using computer assistance is to improve a better accuracy of the prediction.

# II. LITERATURE REVIEW

Naive Bayes Classifier is a classifier model that using a probability and statistic that introduced by Thomas Bayes. The model behind Naive Bayes Classifier has something to do with probability distributions. The aim is to maximize the probability of the target class given the x features.

x are the features  $P(C_k | x_1 x_2 \dots x_n)$ C is the possible outcome of k classes

So the x features can be the income, age and LTI. The C possible outcomes can be 0 or 1 when dealing with the credit scoring problem. 0 if the client defaulted and 1 if the client is able to pay back the debt. We can use Bayestheorem to decompose the conditional probability.

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$$\mathsf{P}(\mathsf{C}_k \mid \mathbf{x}_1 \mathbf{x}_2 \dots \mathbf{x}_n) = \frac{\mathsf{p}(\mathsf{C}_k) \mathsf{p}(s \mid \mathsf{C}_k)}{\mathsf{p}(s)}$$

the same for all ck values

And here comes the naive assumption that the features are independent of each other. Two random variables are independent if the realization of one does not affect the probability distribution of the other. Hence, we can decompose the joint distribution.

$$P(\mathbf{x}_{1}\mathbf{x}_{2}...\mathbf{x}_{n} | \mathbf{C}_{k}) = P(\mathbf{x}_{1} | \mathbf{C}_{k}) P(\mathbf{x}_{2} | \mathbf{C}_{k}) ... P(\mathbf{x}_{n} | \mathbf{C}_{k})$$

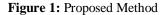
$$P(\mathbf{C}_{k} | \mathbf{x}_{1}\mathbf{x}_{2}...\mathbf{x}_{n}) \sim P(\mathbf{C}_{k}) \prod_{i=1}^{n} p(\mathbf{x}_{i} | \mathbf{C}_{k})$$

You may ask what happened to the p(x) denominator? Because it is the same for all c values, we can omit it. Finally, Naive Bayes Classifier picks the class with the highest probability. So the problem reduces to a maximum finding problem (the dominator does not affect this value).



# Temperature NaiveBayes Humidity Process Air Velocity Result Air Pressure Output

# III. RESEARCH METHOD



Based on Figure 1, the stages of research carried out in determining the weather conditions is inputting the process from taking data in four weather variables in the form of temperature, humidity, air velocity and air pressure, then collected to be processed using the Naïve Bayes algorithm. After the temperature at the input, then carry out the stages of the process of collecting temperature data, air humidity, air velocity and air pressure that

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are useful for the training data, to categorize data on the temperature scale by cold / medium / hot, comfortable / humid humidity, fast / standard air velocity and normal / no air pressure, and then the calculate the probability the occurrence of each class.

# IV. RESULTS AND DISCUSSIONS

In this section contains the result that obtained in this research, to analyze the comparation of the prediction with the actual data, we provide the detail as follows Table 1.

| Time    | Temp    |        | RH      |        | Velocity            |        | Pressure |         |
|---------|---------|--------|---------|--------|---------------------|--------|----------|---------|
|         | Predict | Actual | Predict | Actual | Predict             | Actual | Predict  | Actual  |
| Earlier | 26,17   | 26,65  | 92,69   | 92,50  | 1,08                | 1,55   | 1011,20  | 1011,05 |
| Morning | 30,14   | 29,64  | 69,37   | 71,80  | 1, <mark>4</mark> 7 | 1,00   | 1012,18  | 1012,20 |
| Day     | 30,17   | 28,99  | 71,06   | 77,20  | 2,02                | 1,50   | 1009,72  | 1009,70 |
| Night   | 27,25   | 27,12  | 87,37   | 90,75  | 0,88                | 0,90   | 1012,55  | 1012,30 |

Table 1: Comparation of Prediction

#### 4.1 Naive Bayes Calculation

The steps of manual calculation for the data classification process using the Naive Bayess Classifier method are as follows:

1. Calculate the Probabiliies

 $P(Class|Yes) = \frac{16}{38} = 0.421$  $P(Class|No) = \frac{22}{38} = 0.578$ 

2. Create The Frequency Table from the training data

| Fragua | ncy Table  | Condition |    |  |
|--------|------------|-----------|----|--|
| rieque | iicy rable | Yes       | No |  |
|        | Cold       | 5         | 8  |  |
| Тетр   | Normal     | 5         | 8  |  |
|        | Hot        | 6         | 6  |  |

| Freque   | nov Tabla   | Condition |    |  |
|----------|-------------|-----------|----|--|
| Freque   | ncy Table - | Yes       | No |  |
|          | Dry         | 3         | 9  |  |
| Humidity | Normal      | 9         | 5  |  |
|          | Humid       |           | 8  |  |

| Freque       | ncy Table  | Condition |    |
|--------------|------------|-----------|----|
| Treque       | iley Tuble | Yes       | No |
| Air Velocity | Normal     | 11        | 8  |

| Fast | 5 | 14 |
|------|---|----|
|      |   |    |

| Freque          | Frequency Table |     | Condition |  |  |
|-----------------|-----------------|-----|-----------|--|--|
| rrequency rable |                 | Yes | No        |  |  |
| Air             | Normal          | 13  | 6         |  |  |
| Pressure        | No              | 3   | 16        |  |  |

# V. CALCULATE THE PROBABILITIES

In this section we calculate the probabilities on each City using Naive Bayes Classifier which the results shown in figures below.

| masukkan kotathireus                                   |   |
|--|---|
| Perkiraan Cuada di J                                   | Kota bireuen Tanggal 20 Beptember 2019 adalah:  |
|  | Second |
|  |   |
| Dini Haris   |   |
| Suhn Udere   | / 26.17 Derajar Celdins   |
| Kelenhahan Udara                                       | : 92_69 <b>a</b>  |
| Kecepatan Angin  | 1 1.08 m/e  |
| Tekanan Odara  | 1011.2 hPe  |
|  |   |
| Remult:  |   |
| no> 0.007532233  |   |
| yes ++> 0.01837475                                     | 14407894735   |
| Resievalan   | The second of   |
| cesimpolan   | 1 Byanan  |
|  |   |
| pegi Hari:   |   |
| 1010-0217-0-0-0  |   |
| Suhu Odara   | : 30.14 Derajat Celcius   |
| Kelembaban Udara                                       | 1 69.37 %   |
| Reception Angin  | : 1:47 m/s  |
| Tekanan Udara  | 1 1012.38 hFe   |
|  |   |
| Regult:<br>no =>> 0.004745144                          | 6110952819  |
| ynn -> 0.04134321                                      |   |
| And the Allender                                       |   |
| Kesimpulan   | : Nyaman  |
|  |   |
|  |   |
| siong Barl)  |   |
| Suhu Udara   | : 30.17 Derajat Celuine   |
| Welephaban Udara                                       | E 71,06 %   |
| Recepstan Angin  | z:03 m/m  |
| Tekspan Udara  | 1009-73 tPe   |
|  |   |
| Besult:  |   |
| po ==> 0,004745144                                     |   |
| Yes 0.04154328   | 14114114  |
| Resimpulan   | : Nyaman  |
| malam Sari:  |   |
| mainm Dari:  |   |
| Junu Udare   | : 27.25 Derajah Celmins   |
| Selementers Untern                                     | E 87.27 %   |
| Receptian Angla  | t 0.00 m/s  |
| Texanan Odaza  | : 1012.58:NPa   |
| Passile.   |   |
| Resulti  |   |
|  | Non-Line.   |
|  |   |
| no => 0.007592233<br>yes => 0.01837479                 |   |
| no ==> 0.007592233<br>ges ==> 0.01887479<br>Fesimpulan |   |

Figure 2: Results test on Bireuen City

The results of the weather prediction process using the naïve bayes method shown that the weather clusters between the comfortable or the uncomfortable based on real weather data as air temperature, humidity, air velocity

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and air pressure obtained from the cloud server (meteoblue.com). The data is first entered into the class for each weather parameter, then the p(class) value is calculated, which is getting the result in Bireuen City is comfortable.

| mesuggan kotatbahu   |   |  |  |
|--|---|--|--|
| Permirman Cuncu di Mota gayu Tanggal 20 September 2019 adalah:     |   |  |  |
| Dimi Revil   |   |  |  |
| Subu Udare<br>Melembaban Udara<br>Merepatan Angin<br>Tekanan Udara | : 18.33 Derajat Celmius<br>: 54.25 %<br>: 0.82 m/s<br>: 1011.5 mbu  |  |  |
| Result:<br>to ==> 0.00759225<br>yes ==> 0.0103747                  | 5777531754  |  |  |
| Feeingulan   | + Byanan  |  |  |
| pagi Hari)   |   |  |  |
| Subu Udara   | : 22.09 Derejat Celmius   |  |  |
| Welenbahan Udara   | = 77.09 %<br>= 1.92 m/m<br>= 1012.77 mPm  |  |  |
| Necepatan Angin<br>Takanan Udara                                   | 1 1.92 m/s  |  |  |
| Tekanan Udara  | ± 1012.77 hPa   |  |  |
| Besult:<br>no =>> 0.00474514<br>yes => 0.0413432                   |   |  |  |
| Resimpulan   | i Bynnan  |  |  |
| siang Hari:  |   |  |  |
|  |   |  |  |
| Suhu Udara<br>Kelembaban Udara                                     | 1 22.55 Derejat Celcius   |  |  |
| Secepatan Angin  | 1 2.13 m/m  |  |  |
| Tekanan Udara  | : 1010.15 nFa   |  |  |
| Result:  | ( and a second se |  |  |
| no ==> 0.004745146<br>yes ==> 0.04134335                           |   |  |  |
| Nevimpulan   | i Nyaman  |  |  |
|  |   |  |  |
| malam Haris  |   |  |  |
| Suhu Udaza   | 1 19.66 Derajat Celcius   |  |  |
| Kelembahan Udaya   | ST.57 4   |  |  |
| Secepatan Angin  | : 0.81 m/a  |  |  |
| Tekanan Udara  | i 1012.16 hPe   |  |  |
| Besult:  |   |  |  |
| no> 0.007592233  | 177531754   |  |  |
| ereres10.0. cm eet   | 1407894795  |  |  |
| Zerispulan.  | i Nyaman  |  |  |

Figure 3: Results test on Gayo City

The results of the weather prediction process using the naïve bayes method shown that the weather clusters between the comfortable or the uncomfortable based on real weather data as air temperature, humidity, air velocity and air pressure obtained from the cloud server (meteoblue.com). The data is first entered into the class for each weather parameter, then the p(class) value is calculated, which is getting the result in Gayo City is comfortable. The manual calculations for the accuracy as follows:

$$Accuracy = \frac{21+13}{38} = 0,8947 = 89,47\%$$

# VI. CONCLUSIONS

The accuracy value for the weather prediction using Naive Bayes Classifier is 89,47% which means this algorithm works properly on predicting the weather forecast. This study suggest that the accuracy of the method can significantly improve by combining the Naive Bayes Classifier with another conjungtion methods.

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