CS571/561 – Artificial Intelligence

Mid Semester Examination

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List of Submitted Documents:

For i. Codes with appropriate documentation;
Please see the files **multinomial.ipynb** and **multivariate.ipynb** for codes. I have done the documentation in the codes itself. I have also put the dataset file called **dataset_file**.

This PDF has

ii.   Details of vocabulary words

iii.   Computation of parameters of model (values etc)

iv.   Discussion between multivariate vs. multinomial model with respect to this problem (mention why one is chosen over the other; efficiency with respect to computational power etc)

ii. Details of Vocabulary Words

The vocabulary for the documents D1, D2, D3 is:

1. architecture	9. **facial**	17. **method**	25. technique
2. benefit	10. fr	18. proposed	26. used
3. **computer**	11. hierarchical	19. recent	27. using
4. deep	12. leap	20. **recognition**	28. various
5. discriminative	13. learn	21. representation	29. **vision**
6. dl	14. learning	22. researcher	30. widely
7. enormous	15. made	23. system	31. year
8. face	16. many	24. task	

* Words in **bold** have repetitions

iii. Computation of parameters of model (values etc)

The feature values of the words in the vocabulary have been calculated by the following formula. We have used **Laplace Smoothing** in this calculation.

$$F(\text{word x} \mid \text{class y}) = \log\left(\frac{\text{word x count in class y} + 1}{\text{total words in class y} + \text{total words in Vocabulary}}\right)$$

Here, **x** is a word in the Vocabulary; **y** is a class into which we want to classify word **x**

Feature Values in Multinomial Model:

Feature Values for DL Class

Words	Value
recent	-3.55534806148941
year	-3.55534806148941
researcher	-3.55534806148941
computer	-3.55534806148941
vision	-3.55534806148941
proposed	-3.55534806148941
many	-3.55534806148941
deep	-2.86220088092946
learning	-3.14988295338124
dl	-3.55534806148941
method	-3.14988295338124
various	-3.55534806148941
task	-3.55534806148941
facial	-3.55534806148941
recognition	-3.55534806148941
fr	-3.14988295338124
made	-3.55534806148941
enormous	-3.55534806148941
leap	-3.55534806148941
using	-3.55534806148941
technique	-3.55534806148941
system	-3.55534806148941
benefit	-3.55534806148941
hierarchical	-3.55534806148941
architecture	-3.55534806148941
learn	-3.55534806148941
discriminative	-3.55534806148941
face	-3.55534806148941
representation	-3.55534806148941

Feature Values for CV Class

Words	Value
computer	-3.06805293513361
vision	-3.06805293513361
method	-3.06805293513361
widely	-3.06805293513361
used	-3.06805293513361
facial	-3.06805293513361

Feature Values in Multivariate Model:

Feature Values for DL Class

Words	Values
technique	-0.693147180559945
proposed	-0.693147180559945
fr	-0.287682072451780
year	-0.693147180559945
leap	-0.693147180559945
facial	-0.693147180559945
deep	-0.287682072451780
dl	-0.693147180559945
many	-0.693147180559945
using	-0.693147180559945
recent	-0.693147180559945
various	-0.693147180559945
researcher	-0.693147180559945
learning	-0.287682072451780
recognition	-0.693147180559945
task	-0.693147180559945
made	-0.693147180559945
enormous	-0.693147180559945
vision	-0.693147180559945
method	-0.287682072451780
computer	-0.693147180559945
representation	-0.693147180559945
architecture	-0.693147180559945
hierarchical	-0.693147180559945
learn	-0.693147180559945
face	-0.693147180559945
benefit	-0.693147180559945
discriminative	-0.693147180559945
system	-0.693147180559945

Feature Values for CV Class

Words	Values
method	-0.405465108108164
recognition	-0.405465108108164
computer	-0.405465108108164
facial	-0.405465108108164
used	-0.405465108108164
widely	-0.405465108108164
vision	-0.405465108108164

iv. Discussion between multivariate vs. multinomial model with respect to this problem

Observation: The Multinomial and Multivariate models of Naive Bayes Classifier give the same results for this problem.

Reason:
This is due to the fact that
1. The given dataset is very small for multinomial and multivariate to show varying classifications
2. There not many words in the vocabulary that have repetition. The words that have repetition are: computer, facial, method, recognition, vision

I will prefer Multinomial model over Multivariate model because:
In general Multinomial model performs better than Multivariate model.
Multivariate model uses binary occurrence information and ignores the number of occurrences. Whereas, Multinomial model keeps track of multiple occurrences.
So, Multivariate model makes many mistakes while classifying long documents as it is ignoring counts.

So, despite both models performing similarly on this problem, I will prefer Multinomial model over Multivariate model.

Efficiency in Computation Power:
Both Multinomial and Multivariate models are similar in efficiency in computation power because they have similar time complexity.