Exploring different prior choices for the expectation-maximization algorithm

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Abstract

Needs to be written. -Sufficient introduction of the problem-5%-Sufficient explanation of the importance of this problem(e.g. motivation)-5%-A detailed description of the proposed approach is clearly given.-7.5%-The experiments (data, training/testing environment, etc.) and evaluation procedures/metrics are clearly presented-5%-Results/demosare shownwith explanations-7.5%-A discussion of any challenges that were encountered, differences between the final approach and the proposed approach, and potential future work-5%-List of key referencesand any used open source libraries/packages that were used-5%

**Index Terms**: mixture of Gaussians, expectation maximization

# Introduction

The Mixture of Gaussians (MOG) is a useful model in many industry and research settings. It can be used for spam detection by categorizing heterogeneous documents to make the feature space easier to understand. It can be also used to classify emotions in speech audio, thus paving the way for more responsive human-computer interactions.

The MOG model is often solved with an algorithm called "Expectation-Maximization" (EM). EM is a numerical procedure which begins with a set of possible distributions, and adjusts their parameters iteratively to yield their maximum a posteriori estimates. We implemented this algorithm in class using equally-likely Normal priors, with mu and sigma initialized randomly from ~Normal(0, 1). In this project, we investigate if superior prior choices exist. We came up with a few ideas, tested them on multivariate synthetic and real-world datasets, and compared the convergences and model accuracies. Our results are relevant to anyone interested in solving MOGs more efficiently and accurately.

# Methods

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* Proceedings will be printed in DIN A4 format. Authors must submit their papers in DIN A4 format.
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Section headings are centered in boldface with the first word capitalized and the rest of the heading in lower case. Sub- headings appear like major headings, except they start at the left margin in the column. Sub-sub-headings appear like sub-headings, except they are in italics and not boldface. See the examples in this file. No more than 3 levels of headings should be used.

## Data

### Synthetic

### Real-world

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## Tables

An example of a table is shown in Table 1. The caption text must be above the table.

Table 1: *This is an example of a table.*

|  |  |
| --- | --- |
| Ratio | Decibels |
| 1/1 | 0 |
| 2/1 | ≈ 6 |
| 3.16 | 10 |
| 1/10 | 20 |
| 10/1 | -20 |
| 100/1 | 40 |
| 1000/1 | 60 |

Figure 1: *Schematic diagram of speech production.*

## Equations

Equations should be placed on separate lines and numbered. Examples of equations are given below. Particularly,

 (1)

where  is a special warping function

 (2)

A residue theorem states that

 (3)

Applying (3) to (1), it is quite straightforward to see that

 (4)

Finally we have proven the secret theorem of all speech sciences. No more math is needed to show how useful the result is!

## Information for Word users only

For ease of formatting, please use the styles listed in Table 2. The styles are defined in this template file and are shown in the order in which they would be used when writing a paper.

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Table 2: *Main predefined styles in Word.*

|  |  |
| --- | --- |
| Style Name | Entities in a Paper |
| Title | Title |
| Author | Author name |
| Affiliation | Author affiliation |
| Email | Email address |
| AbstractHeading | Abstract section heading |
| Body Text | First paragraph in abstract |
| Body Text Next | Following paragraphs in abstract |
| Index | Index terms |
| 1. Heading 1 | 1st level section heading |
| 1.1 Heading 2 | 2nd level section heading |
| 1.1.1 Heading 3 | 3rd level section heading |
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| Body Text Next | Following paragraphs in section |
| Figure Caption | Figure caption |
| Table Caption | Table caption |
| Equation | Equations |
| • List Bullet | Bulleted lists |
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# Discussion

## Convergence speed

## Model accuracy

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# Conclusions

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