A Network Model for Dynamic Textual Communications with Application to Government Email Corpora

Bomin Kim
Institution 1

Aaron Schein
Institution 2

Bruce Desmarais
Institution 3

Hanna Wallach
Institution 4

Abstract

In this paper, we introduce the interaction-partitioned topic model (IPTM)—a probabilistic model for who communicates with whom about what, and when. Broadly speaking, the IPTM partitions time-stamped textual communications, such as emails, according to both the network dynamics that they reflect and their content. To define the IPTM, we integrate a dynamic version of the exponential random graph model—a generative model for ties that tend toward structural features such as triangles—and latent Dirichlet allocation—a generative model for topic-based content. The IPTM assigns each topic to an "interaction pattern"—a generative process for ties that is governed by a set of dynamic network features. Each communication is then modeled as a mixture of topics and their corresponding interaction patterns. We use the IPTM to analyze emails sent between department managers in Dare county government in North Carolina; these email corpora covers the Outer Banks during the time period surrounding Hurricane Sandy. Via this application, we demonstrate that the IPTM is effective at predicting and explaining continuous-time textual communications.

1 GENERAL FORMATTING INSTRUCTIONS

The camera-ready versions of the accepted papers are 8 pages, plus any additional pages needed for references.

Preliminary work. Under review by AISTATS 2018. Do not distribute.

Papers are in 2 columns with the overall line width of 6.75 inches (41 picas). Each column is 3.25 inches wide (19.5 picas). The space between the columns is .25 inches wide (1.5 picas). The left margin is 1 inch (6 picas). Use 10 point type with a vertical spacing of 11 points. Please use US Letter size paper instead of A4.

Paper title is 16 point, caps/lc, bold, centered between 2 horizontal rules. Top rule is 4 points thick and bottom rule is 1 point thick. Allow 1/4 inch space above and below title to rules.

Author descriptions are center-justified, initial caps. The lead author is to be listed first (left-most), and the Co-authors are set to follow. If up to three authors, use a single row of author descriptions, each one center-justified, and all set side by side; with more authors or unusually long names or institutions, use more rows.

Use one-half line space between paragraphs, with no indent.

2 FIRST LEVEL HEADINGS

First level headings are all caps, flush left, bold, and in point size 12. Use one line space before the first level heading and one-half line space after the first level heading.

2.1 Second Level Heading

Second level headings are initial caps, flush left, bold, and in point size 10. Use one line space before the second level heading and one-half line space after the second level heading.

2.1.1 Third Level Heading

Third level headings are flush left, initial caps, bold, and in point size 10. Use one line space before the third level heading and one-half line space after the third level heading.

Fourth Level Heading Fourth level headings must be flush left, initial caps, bold, and Roman type. Use one line space before the fourth level heading, and place the section text immediately after the heading with no line break, but an 11 point horizontal space.

2.2 CITATIONS, FIGURES, REFERENCES

2.2.1 Citations in Text

Citations within the text should include the author's last name and year, e.g., (Cheesman, 1985). References should follow any style that you are used to using, as long as their style is consistent throughout the paper. Be sure that the sentence reads correctly if the citation is deleted: e.g., instead of "As described by (Cheesman, 1985), we first frobulate the widgets," write "As described by Cheesman (1985), we first frobulate the widgets."

2.2.2 Footnotes

Indicate footnotes with a number[1] in the text. Use 8 point type for footnotes. Place the footnotes at the bottom of the column in which their markers appear, continuing to the next column if required. Precede the footnote section of a column with a 0.5 point horizontal rule 1 inch (6 picas) long.[2]

2.2.3 Figures

All artwork must be centered, neat, clean, and legible. All lines should be very dark for purposes of reproduction, and art work should not be hand-drawn. Figures may appear at the top of a column, at the top of a page spanning multiple columns, inline within a column, or with text wrapped around them, but the figure number and caption always appear immediately below the figure. Leave 2 line spaces between the figure and the caption. The figure caption is initial caps and each figure should be numbered consecutively.

Make sure that the figure caption does not get separated from the figure. Leave extra white space at the bottom of the page rather than splitting the figure and figure caption.

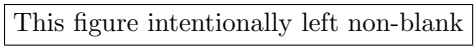

Figure 1: Sample Figure Caption

[1]Sample of the first footnote.
[2]Sample of the second footnote.

2.2.4 Tables

All tables must be centered, neat, clean, and legible. Do not use hand-drawn tables. Table number and title always appear above the table. See Table 1.

Use one line space before the table title, one line space after the table title, and one line space after the table. The table title must be initial caps and each table numbered consecutively.

Table 1: Sample Table Title

PART	DESCRIPTION
Dendrite	Input terminal
Axon	Output terminal
Soma	Cell body (contains cell nucleus)

3 SUPPLEMENTARY MATERIAL

If you need to include additional appendices during submission, you can include them in the supplementary material file.

4 INSTRUCTIONS FOR CAMERA-READY PAPERS

For the camera-ready paper, if you are using LaTeX, please make sure that you follow these instructions. (If you are not using LaTeX, please make sure to achieve the same effect using your chosen typesetting package.)

1. Download `fancyhdr.sty` – the `aistats2018.sty` file will make use of it.
2. Begin your document with

   ```
   \documentclass[twoside]{article}
   \usepackage[accepted]{aistats2018}
   ```

   The `twoside` option for the class article allows the package `fancyhdr.sty` to include headings for even and odd numbered pages. The option `accepted` for the package `aistats2018.sty` will write a copyright notice at the end of the first column of the first page. This option will also print headings for the paper. For the *even* pages, the title of the paper will be used as heading and for *odd* pages the author names will be used as heading. If the title of the paper is too long or the number of authors is too large, the style will print a warning message as heading. If this happens additional commands can be used to place as headings shorter versions of the title and the author names. This is explained in the next point.

3. If you get warning messages as described above, then immediately after `\begin{document}`, write

   ```
   \runningtitle{Provide here an alternative
   shorter version of the title of your
   paper}
   \runningauthor{Provide here the surnames
   of the authors of your paper, all
   separated by commas}
   ```

   Note that the text that appears as argument in `\runningtitle` will be printed as a heading in the *even* pages. The text that appears as argument in `\runningauthor` will be printed as a heading in the *odd* pages. If even the author surnames do not fit, it is acceptable to give a subset of author names followed by "et al."

4. Use the file sample_paper.tex as an example.

5. The camera-ready versions of the accepted papers are 8 pages, plus any additional pages needed for references.

6. If you need to include additional appendices, you can include them in the supplementary material file.

7. Please, don't change the layout given by the above instructions and by the style file.

Acknowledgements

Use unnumbered third level headings for the acknowledgements. All acknowledgements go at the end of the paper.

References

References follow the acknowledgements. Use an unnumbered third level heading for the references section. Any choice of citation style is acceptable as long as you are consistent. Please use the same font size for references as for the body of the paper—remember that references do not count against your page length total.

J. Alspector, B. Gupta, and R. B. Allen (1989). Performance of a stochastic learning microchip. In D. S. Touretzky (ed.), *Advances in Neural Information Processing Systems 1*, 748-760. San Mateo, Calif.: Morgan Kaufmann.

F. Rosenblatt (1962). *Principles of Neurodynamics.* Washington, D.C.: Spartan Books.

G. Tesauro (1989). Neurogammon wins computer Olympiad. *Neural Computation* **1**(3):321-323.