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A CORRELATED TOPIC MODEL OF SCIENCE²

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Topic models, such as latent Dirichlet allocation (LDA), can be useful tools for the statistical analysis of document collections and other discrete data. The LDA model assumes that the words of each document arise from a mixture of topics, each of which is a distribution over the vocabulary. A limitation of LDA is the inability to model topic correlation even though, for example, a document about genetics is more likely to also be about disease than X-ray astronomy. This limitation stems from the use of the Dirichlet distribution to model the variability among the topic proportions. In this paper we develop the correlated topic model (CTM), where the topic proportions exhibit correlation via the logistic normal distribution [*J. Roy. Statist. Soc. Ser. B* 44 (1982) 139–177]. We derive a fast variational inference algorithm for approximate posterior inference in this model, which is complicated by the fact that the logistic normal is not conjugate to the multinomial. We apply the CTM to the articles from *Science* published from 1990–1999, a data set that comprises 57M words. The CTM gives a better fit of the data than LDA, and we demonstrate its use as an exploratory tool of large document collections.

1. Introduction. Large collections of documents are readily available on-line and widely accessed by diverse communities. As a notable example, scholarly articles are increasingly published in electronic form, and historical archives are being scanned and made accessible. The not-for-profit organization JSTOR (www.jstor.org) is currently one of the leading providers of journals to the scholarly community. These archives are created by scanning old journals and running an optical character recognizer over the pages. JSTOR provides the original scans on-line, and uses their noisy version of the text to support keyword search. Since the data are largely unstructured and comprise millions of articles spanning centuries of scholarly work, automated analysis is essential. The development of new tools for browsing, searching and allowing the productive use of such archives is thus an important technological challenge, and provides new opportunities for statistical modeling.

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Supplementary material and code are available at <http://fmstat.org/aaas/supplements>

Key words and phrases. Hierarchical models, approximate posterior inference, variational methods, text analysis.

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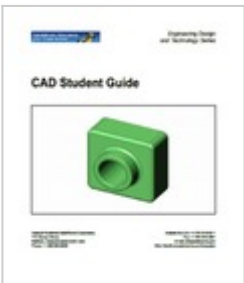
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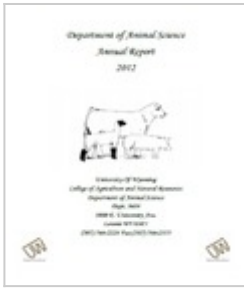
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