

**REDACTED**

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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FACEBOOK, INC., LINKEDIN CORP., AND TWITTER, INC.,  
Petitioners

v.

SOFTWARE RIGHTS ARCHIVE, LLC  
Patent Owner

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Case IPR2013-00480  
Patent 5,832,494

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**DECLARATION OF AMY LANGVILLE**  
in Support of Patent Owner Response

**EXHIBIT 2114**

*Facebook, Inc. et al.*

v.

*Software Rights Archive, LLC*

I, Amy Langville, declare as follows:

1. My name is Amy Langville. I am a tenured Associate Professor of Mathematics at the College of Charleston. My business address is 1014 E. Ashley Avenue, P.O. Box 295, Folly Beach, SC 29439. I understand that my declaration is being submitted in connection with the above-referenced *inter partes* review proceeding.

## **I. QUALIFICATIONS, BACKGROUND, AND EXPERIENCE**

### **A. Background and Experience**

2. I was hired as an Associate Professor of Mathematics at The College of Charleston in 2004 and obtained tenure in 2010. In my current position at The College of Charleston, my teaching responsibilities range from undergraduate, general service courses in Calculus and Linear Algebra to graduate special topics courses in Linear Optimization, Evolutionary Optimization, Operations Research, and Integer Programming. I also have research mentoring duties. Consequently, I have supervised over two dozen student projects and B.S., M.S. and Ph.D. theses, covering such topics as ranking, clustering, graph theory, and optimization.

3. I am also the Operations Research specialist in our department, having received my M.S. and Ph.D. degrees in Operations Research from N.C. State University in 1999 and 2002, respectively. During one summer of graduate school, I worked for The National Security Agency in their Operations Research program,

researching network problems. My Ph.D. dissertation topic was Markov chains, which a few years later I learned was the mathematical process underlying the PageRank algorithm used by Google's search engine for ranking webpages.<sup>1</sup>

4. After my Ph.D., I took a postdoctoral position in the Mathematics Department at N.C. State University from 2002-2005, where I studied the mathematics of search engines. In particular, I studied Google's search engine and its PageRank algorithm.

5. My research and technical expertise are sought out by both business and professional scientific organizations. In particular, I have worked with the following companies, as a consultant and/or member of the Advisory Board: U.S. Olympic Committee, The Boeing Corporation, The SAS Institute, Semandex, Piffany, Fortune Interactive, Your Music On, Trilogy Excursions, College Football Performance Awards, and Tiger Falcon's Prediculous. In addition, I am frequently requested to review work in my field by the National Science Foundation, Princeton University Press, and many scientific journals. While each reviewing responsibility appears in the attached curriculum vitae, here I list just a few of the more recognizable journals from a wide range of professional organizations (ACM, INFORMS, SIAM, WWW, and IEEE): The Association for Computing

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<sup>1</sup> See Ex. 2053: Sergey Brin and Lawrence Page, *The Anatomy of a Large-Scale Hypertextual Search Engine*, WWW, 1998; Ex. 2054: Lawrence Page, Sergey Brin, Rajeev Motwani and Terry Winograd, *The PageRank Citation Ranking: Bringing Order to the Web*, Technical Report, Stanford InfoLab, December 2008.

Machinery's Transactions on Information Systems, the Institute for Operations Research and Management Science's Journal on Computing, The Society for Industrial and Applied Mathematics' Review, the World Wide Web conference, and the Institute for Electrical and Electronics Engineers' Transactions on Signal Processing.

6. I have chaired several symposiums and conferences in my field, including The Markov Anniversary Meeting in 2006, the Southeastern Ranking and Clustering workshop in 2009, and symposiums at the annual meetings of the Mathematical Association of America (MAA), the American Mathematical Society (AMS), and the Society for Industrial and Applied Mathematics (SIAM).

7. I have received many awards for these activities. For example, within my university, I received the prestigious Distinguished Teacher-Scholar award, the Gordon E. Jones Distinguished Achievement award, and the Faculty of the Year award. From N.C. State University, I received a Distinguished Alumni award. In my state, I was nominated for the S.C. Governor's Award for Excellence in Science and was a finalist for the S.C. Professor of the Year. Nationally, I have been selected to be a member of the Committee for Women in Mathematics, a group representing the AWM, MAA, AMS, INFORMS, and SIAM professional organizations. My books, publications, and algorithms have received many awards, a few of which are described in the next few sections.

## B. Publications and Conferences

8. I have authored two books that specifically concern Google, its search engine, and the “PageRank” algorithm used by its search engine. The first book, published in 2006 by Princeton University Press, is titled *Google’s PageRank and Beyond: The Science of Search Engine Rankings*. This book won the runner-up award for the Best New Book in Information Science from the Association of American Publishers and has been translated into Japanese and Greek with a Russian translation under contract. The second book, published in January 2012 by Princeton University Press, is titled *Who’s #1? The Science of Ranking and Rating*. It covers ranking more broadly with applications, methods, and measures beyond the web. A book on my clustering research is underway and expected to be completed in 2015. My clustering research includes two clustering algorithms, which were adopted by the popular software programs of SAS’s Enterprise Miner and MATLAB’s Matrix Laboratory software.

9. In 2006, I was the co-editor for *The Proceedings of the Markov Anniversary Meeting*, a compendium of work on Markov chains.

10. In addition to the books mentioned above, my research has been published in over 40 papers. My complete publication list appears in the attached curriculum vitae (**Appendix A**). Those publications include the following: The 2006 paper “A Survey of Eigenvector Methods for Web Information Retrieval”

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