Carl B. Allendoerfer Awards

The Carl B. Allendoerfer Award, established in 1976, is made to authors of expository articles published in *Mathematics Magazine*. Carl B. Allendoerfer, a distinguished mathematician at the University of Washington, served as president of the Mathematical Association of America, 1959–60.

Tien Chih and Demitri Plessas

"A Search for Champion Boxers," *Mathematics Magazine*, 95:1, 37–48.
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What does boxing have in common with Google PageRank? This delightful article explains how boxers (or other athletes) can be compared using Markov chains, much like the way PageRank compares websites.

"A Search for Champion Boxers" begins with a quote by boxer Mike Tyson about his opponent Evander Holyfield, raising the question: How can fans aggregate data about wins, losses, and ties to rank boxers (some of whom may never have faced each other)? The authors give a brief, clear introduction to Markov matrices, using an analogy of "sharing water" that will be a welcome complement to the stochastic probability interpretation to readers who need to teach students about Markov chains.

The authors present several easy-to-understand examples of boxing networks—digraphs in which edges connect competitors who have faced each other, representing the flow of "value" (or evidence of skill) from a boxer who has lost a match to one who has won. The authors propose a logical approach to converting a matrix of wins and losses into a stochastic matrix, and for ensuring that disconnected networks still result in a unique ranking. The stable state, or left eigenvector for eigenvalue 1, then contains the score of each boxer, allowing them to be ranked. Section 4 of the paper presents a succinct summary of the algorithm for ranking boxers, helping readers to put it all together and appreciate the big picture.

The article then connects the mathematics back to the question from the beginning of the article by applying the algorithm to rank 20 top heavyweight boxers from the 1990s, including Mike Tyson and Evander Holyfield. The authors compare their approach to another matrix-based ranking system, the Colley method, both using a holistic description of the key differences between the approaches (PageRank is insensitive to the difference between 1, 5, or 100 victories between two opponents, but is more sensitive to upset victories), and by presenting a Colley-ranked list of the same 20 heavyweight boxers from the 1990s. The article concludes with suggestions of further questions about ranking athletes which are sure to inspire fans of both sports and Markov chains.

Throughout, "A Search for Champion Boxers" uses clear explanations, helpful diagrams, and a concrete application, making it a joy to read. This arti-

cle is not only a fun excursion into math and sports, but an excellent resource for those wishing to engage students in their first foray in stochastic matrices.

Responses

Tien Chih: I am grateful and humbled to be receiving the Carl B. Allendoerfer award. I am pleased to know that an idea inspired by late-night binge watching with my newborn son would lead to this honor. I want to thank my family for their support and inspiration.

Demitri Plessas: I am deeply humbled and honored to receive the Mathematical Association of America's Allendoerfer Award for our paper, "A Search for Champion Boxers." I recall reading Larry Gerstein's "Pythagorean Triples and Inner Products" in *Mathematics Magazine* as an undergraduate (Vol. 78, No. 3 (Jun., 2005), pp. 205–213). Gerstein's captivating approach to the subject matter opened my eyes to the beauty and power of the connections within mathematics. So, when my friend and colleague, Tien Chih, suggested we explore sports ranking, I was enthusiastic to join him. In "A Search for Champion Boxers," we sought to blend the elegance of mathematics with the dynamic world of sports, aiming to provide an accessible and engaging entry point for students and enthusiasts alike to the world of mathematics and data science. The award citation eloquently highlights the essence of our work—the connection between ranking in boxing, Google PageRank, and Markov chains. We strove to make complex concepts more approachable by presenting them in the context of ranking heavyweight boxers. Our hope was to inspire readers to delve deeper into the world of mathematics and see the potential for interdisciplinary exploration. I am grateful to the MAA for acknowledging our efforts and bestowing upon us the Allendoerfer Award. This recognition serves as a testament to the power of collaboration and the unending pursuit of knowledge. I would like to express my heartfelt appreciation to my co-author, Tien Chih, for his invaluable partnership in this endeavor, and to Larry Gerstein, whose inspiring work set me on the path to explore the beauty in the connections within mathematics.

Biographical Sketches

Tien Chih received his PhD from the University of Montana. He is an assistant professor of mathematics at Oxford College of Emory University. He enjoys cooking, gardening, and biking with his son.

Demitri Plessas earned a BS from Montana Tech, and an MA and PhD from the University of Montana. He loves blending mathematics and statistics to tackle unique healthcare modeling challenges as a Lead Data Scientist at Edifecs. As the proud father of a son and a daughter, his greatest joy in life is seeing the world through their eyes.