BIOGRAPHICAL SKETCH

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NAME: Cavanaugh, Joseph E.

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POSITION TITLE: Professor

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	Completion Date MM/YYYY	FIELD OF STUDY
Montana Tech	B.S.	05/1986	Mathematics
Montana Tech	B.S.	05/1986	Computer Science
Montana State University	M.S.	06/1988	Statistics
University of California, Davis	Ph.D.	06/1993	Statistics

A. Personal Statement

Dr. Joseph E. ("Joe") Cavanaugh received a B.S. in Computer Science and a B.S. in Mathematics from Montana Technical University in 1986. He was Valedictorian of the 1986 graduating class, and earned the award for Highest Scholastic Standing in the Arts and Sciences. He received his M.S. in Statistics from Montana State University in 1988, and his Ph.D. in Statistics from the University of California, Davis, in 1993. From 1993 to 2003, he was on the faculty of the Department of Statistics at the University of Missouri – Columbia. He is currently a Professor of Biostatistics and the Head of the Department of Biostatistics in the College of Public Health at the University of Iowa, where he has worked since 2003. He holds a secondary appointment in the Department of Statistics and Actuarial Science, and an affiliate appointment in the interdisciplinary doctoral program in Applied Mathematical and Computational Sciences.

Dr. Cavanaugh has published over 160 peer-reviewed manuscripts, over 50 of which feature methodological research contributions to statistics and biostatistics. He has published extensively in the areas of model selection and time series analysis. His applied, interdisciplinary research contributions span a wide range of fields, including cardiology, critical care, dentistry, ergonomics, gerontology, health services utilization, hospice care, hospital epidemiology, immunology, nutrition, oncology, periodontology, pharmacy, psychiatry, psychology, pulmonary care, school violence, and sports medicine. He has made numerous contributions to the areas of infectious diseases epidemiology and injury prevention. He is an Elected Fellow of the American Statistical Association, and an Elected Member of the International Statistical Institute.

Dr. Cavanaugh has supervised 18 doctoral dissertations and 37 master's projects. He has received several awards for teaching and mentoring, including the William T. Kemper Fellowship for Excellence in Teaching at the University of Missouri (in 2000), the College of Public Health Faculty Teaching Award at the University of Iowa (in 2006), and the College of Public Health Faculty Mentor Award at the University of Iowa (in 2019).

B. Positions, Scientific Appointments, and Honors

Positions and Employment

2015-	Professor and Head, Department of Biostatistics, College of Public Health, University of Iowa
2014-2015	Professor, Director of Graduate Studies, and Interim Head, Department of Biostatistics, College of Public Health, University of Iowa
2012-2014	Professor and Director of Graduate Studies, Department of Biostatistics, College of Public Health, University of Iowa
2008-	Professor, Department of Statistics and Actuarial Science, University of Iowa (Secondary Appointment)
2008-2012	Professor, Department of Biostatistics, College of Public Health, University of Iowa
2003-2008	Associate Professor, Department of Statistics and Actuarial Science, University of Iowa (Secondary Appointment)
2003-2008	Associate Professor, Department of Biostatistics, College of Public Health, University of Iowa
2000-2003	Associate Professor and Director of Undergraduate Studies, Department of Statistics, University of Missouri
1999-2000	Associate Professor, Department of Statistics, University of Missouri
1998-1999	Assistant Professor and Director of Graduate Studies, Department of Statistics, University of Missouri
1993-1998	Assistant Professor, Department of Statistics, University of Missouri

Honors

2019	Elected Member of the International Statistical Institute
2019	College of Public Health Faculty Mentoring Award, University of Iowa
2017	Hancher-Finkbine Faculty Medallion, University of Iowa
2014	Fellow of the American Statistical Association
2013	Chancellor's Medallion Recipient, Montana Tech
2013	College of Public Health Faculty Service Award, University of Iowa
2006	College of Public Health Faculty Teaching Award, University of Iowa
2000	William T. Kemper Fellowship for Excellence in Teaching, University of Missouri
1998	Gold Chalk Award (for the training & mentoring of graduate students), University of Missouri
1997	Provost Outstanding Junior Faculty Teaching Award, University of Missouri

C. Contributions to Science

My methodological research interests can be loosely grouped into two main areas: model selection and diagnosis, and time series analysis. My work on model selection and diagnosis has focused on the development and investigation of model selection criteria and case-deletion diagnostics, particularly those based on discrepancy measures such as the Kullback (1968) directed and symmetric divergence.

I. **Model Selection: Variants of the Akaike Information Criterion**. The well-known Akaike (1973) information criterion (AIC) is derived as an estimator of the Kullback directed divergence. Some of my work has dealt with the construction and characterization of improved variants of AIC. The resulting publications include [1] and [2], which propose AIC variants based on bootstrapping and Monte Carlo simulation for use in the state-space time series modeling framework. These two AIC variants are now both available in the popular MARSS (Multivariate Autoregressive State-Space) R package.

1. **Cavanaugh JE** and Shumway RH. A bootstrap variant of AIC for state-space model selection. Statistica Sinica, 7:473-496, 1997.
2. Bengtsson T and **Cavanaugh JE**. An improved Akaike information criterion for state-space model selection. Computational Statistics and Data Analysis, 50:2635-2654, 2006.

II. **Model Selection: Criteria Based on Kullback's Symmetric Divergence**. In 1999, I published a paper [3] that introduces the idea of developing model selection criteria based on Kullback's symmetric divergence, and provides a rationale for favoring the symmetric over the directed divergence. This highly cited paper led to the development of a new class of model selection criteria that have come to be known as Kullback information criteria (KIC). I followed up this work in several publications, including [4], yet a number of other authors have also contributed to the expansion of this criterion class. To date, several dozen methodological papers have been published on KIC and its variants. The criterion class has met with particular success in signal processing applications.

3. **Cavanaugh JE** (1999) A large-sample model selection criterion based on Kullback's symmetric divergence. Statistics & Probability Letters, 44:333-344.
4. **Cavanaugh JE** (2004). Criteria for linear model selection based on Kullback's symmetric divergence. Australian and New Zealand Journal of Statistics, 46:257-274.

III. **Predictive Modeling Diagnostics**. The problems of model selection and model diagnosis frequently intertwine, and discrepancy measures are often used in the development of tools to address both problems. My work on model diagnosis has focused on the construction and investigation of a case-deletion diagnostic called the predictive influence function, which characterizes the impact of a case on the prediction of latent or missing data. The publications that have resulted from this work include [5] and [6], the former which develops a diagnostic for state-space modeling applications.

5. **Cavanaugh JE** and Johnson WO (1999). Assessing the predictive influence of cases in a state-space process. Biometrika, 86:183-190.
6. **Cavanaugh JE** and Oleson JJ (2001). A diagnostic for assessing the influence of cases on the prediction of missing data. Journal of the Royal Statistical Society, Series D, 50:427-440.

IV. **Time Series Analysis: State-Space Modeling**. My work in time series analysis has primarily focused on the state-space framework, and include the previously mentioned contributions [1], [2], and [5]. My time series contributions also include [7] and [8], which develop modeling framework for the modeling of zero-inflated count time series. The methodology in this paper has been implemented in a recently published R package ZIM (Zero-Inflated Models).

7. Yang M, Zamba GKD and **Cavanaugh JE** (2013). Markov regression models for count time series with excess zeros: A partial likelihood approach. Statistical Methodology, 14:26-38, 2013.
8. Yang M, **Cavanaugh JE** and Zamba GKD (2014). State-space models for count time series with excess zeros. Statistical Modelling, 15:70-90.

V. **Interdisciplinary Collaborations**. I have an active applied, interdisciplinary research agenda. My contributions span a wide range of fields, including cardiology, critical care, dentistry, ergonomics, gerontology, health services utilization, hospice care, hospital epidemiology, immunology, infectious diseases, injury prevention, periodontology, pharmacy, psychiatry, psychology, pulmonary care, and sports medicine.