

Bruce B. MacLeod, Ph.D

Computer Science Department
University of Southern Maine
Portland, Maine
(207) 780-4285
E-mail: macleod@maine.edu

Professional Profile

Faculty member in the computer science department at the University of Southern Maine. Course responsibilities include graduate and undergraduate courses in Problem Solving with Java, Machine Learning and Object Oriented Design. Over three decades of experience in developing software technology for health research in low resource settings. Software Architect for MoTeCH, a mobile-phone based information system for rural health nurses in Ghana that also supports the sending of text messages and voice calls to notify pregnant women about good health practices and appointments. Designed and developed OpenHDS and HRS (Household Registration System), software systems for health research centers in developing countries that enables data entry, reporting, and analysis of longitudinal, community-based, health data. This system is the software standard for INDEPTH network of health research centers (www.indepth-network.org) Current interests and research involves application of deep learning techniques to biological and medical domains.

EDUCATION

- Ph.D. Computer Science, University of Massachusetts, 1989. Thesis: *OPL: A Notation and Solution Methodology for Hierarchically Structured Optimization Problems*
- M.S. Computer Science, University of Massachusetts, 1985
- M.S. Operations Research and Statistics, Rensselaer Polytechnic Institute, 1981
- A.B. Economics and Environmental Science, Bowdoin College, 1979

PROFESSIONAL EXPERIENCE

Employment:

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| 9/2021 to Present | Associate Professor and Chair, Department of Computer Science, University of Southern Maine, Portland |
| 9/2015 to 8/2021 | Associate Professor, Department of Computer Science, University of Southern Maine, Portland |
| 11/2011 to 6/2016 | Senior Lecturer, Columbia University, New York, NY.
Heilbrunn Department of Population and Family Health. |
| 10/2014-8/2015 | Department Chair and Associate Professor, Department of Computer Science, University of Southern Maine, Portland |
| 7/2009-10/2011 | Visiting Research Scientist, Columbia University, New York, NY.
Heilbrunn Department of Population and Family Health. |

5/2000-5/2002	Department Chair and Associate Professor, Department of Computer Science, University of Southern Maine, Portland
9/1992-5/2000	Associate Professor, Department of Computer Science, University of Southern Maine, Portland
9/1986-9/1992	Assistant Professor, Department of Computer Science, University of Southern Maine, Portland
6/1981-6/1982	Senior Operations Analyst, Chase Manhattan Bank, Internal Consulting Group, New York, NY

Grants and Research Projects:

Fall 2008-Spring 2016 (PI) MoTECH : (Mobile Technology for Community Health) is a collaborative project with Ghana Health Service, Columbia University and Grameen foundation that uses text messages and voice to notify pregnant women about good health practices and appointments. In addition, this project developed an information system designed to improve the timeliness, accuracy, and utility of information required by district managers, supervisors, and frontline health workers. MoTeCH has been in operation in the northeast region of Ghana since Summer 2010. Recent work on MoTeCH involves software development to support larger scale applications and different health domains.

Fall 2014-Spring 2016 (PI) CIMS: (Mobile Technology for Community Health) The CIMS is an MCDI funded research project that provides operational support for elimination campaigns that reduce and eliminate Malaria from Bioko Island in Equatorial Guinea.

Fall 2014-Spring 2016 (Co-PI) Health Data Research Cluster, USM An MEIF funded project involving USM's Computer Science Department and the Muskie School of Public Health to enhance USM's capabilities to tackle big data problems in health care delivery, financing, and population health. Our work focuses on efficiently processing large quantities of using new technologies for distributed data representation and analysis, algorithms for heterogeneous data linkages, systems integration with real-time data sources, and data interpretation based on machine learning algorithms.

Fall 2009-December 2012 (PI) CRHDS for NEHSI: is an IDRC funded project for the design and development of a health and demographic application that supports research on the Nigerian National Health Information System. The project, based in Cross River Nigeria, is done in collaboration with faculty at the University of Calabar, Nigeria.

2008-December 2011 OMEVAC : Research and software development to replace paper based data collection instruments for clinical trials in low-resource countries with mobile applications software. The goal is to have researchers and field workers use handheld devices to directly enter clinical trial information. Ultimately, this would reduce the logistical challenges related to paper handling and digitalization.

2006-2009 Research Computing Group, University of Southern Maine: Responsible for identifying strategic directions for computing research at USM. Lead member of an interdisciplinary team of Marine research scientists and computer scientists who are developing data models and mapping software to characterize the biodiversity of the Gulf of Maine ecosystem.

2004-2008 Makerere University, Kampala Uganda: Development of data entry systems using handhelds. Co-Principal investigator in a software project that involved developers from Norway, Uganda, and the United States.

2003-2010 INDEPTH Scientific Advisory Board : The INDEPTH network is an international network of field sites with continuous demographic evaluation of populations and their health in developing countries. Helped set the strategic agenda for collaborative scientific research at INDEPTH health research stations.

1990-2008 Population Council, NY: Ongoing collaboration with Dr. James Phillips, Senior Research Associate. Designed and developed a software system to allow health researchers to construct data entry and monitoring systems for longitudinal studies. Software (HRS) used in many sites worldwide including the Navrongo Health Research Center in Northern Ghana, the Community Health Research Laboratory in Yogyakarta, Indonesia, the Uganda Virus Institute in Entebbe, Uganda and the Medical Research Council Laboratory in Farafenni, The Gambia

Fall 2005-Fall 2006 Ghana Health Service, Ghana Development of a Monitoring and evaluation web site for key indicators of progress towards community health planning and service programs in Ghana. (<http://www.ghana-chps.org/to2.htm>) . Website used open source mapping software to display key indicators in different formats including maps, graphs, and tables.

Spring 2005 Hanoi School of Public Health, Vietnam: Analysis of longitudinal data & further development of software to monitor adolescent health intervention strategies.

Spring 2003 Hanoi School of Public Health, Vietnam: Development of software to monitor adolescent health intervention strategies.

2000 University of Ghana, Legon Ghana : Development of a Health Informatics academic program. Collaboration with INDEPTH, School of Public Health, and the Computer Science Department to establish international level curriculum to meet the health information needs of developing countries.

1991-2003 Navrongo Health Research Center, Ghana : Development of software to monitor the impact of a malaria intervention strategy on children. Conducted four separate seminars at the center since Feb. 1991.

2000-2002 : UERD, Burkina Faso :Development of next generation software systems for data entry using Pocket PCs.

1997-98 : Thrasher Foundation Grant: Development of longitudinal surveillance software and Internet based remote technical assistance.

Before 1997 : Grants include software development projects with local companies Candle Corporation and IDEXX. Research and development grants from Rockefeller Foundation, UNICEF, Ford Foundation, and the ICCDR B, Bangladesh.

PUBLICATIONS

Phillips JF, MacLeod BB, Kachur SP. Bugs in the Bed: Addressing the Contradictions of Embedded Science with Agile Implementation Research. Glob Health Sci Pract. 2021 Mar 31;9(1):55-77.

- Asangansi, Ime, Bruce MacLeod, David Roberge, Brian Hartsock, Martin Meremikwu, Iwara Arikpo, Mboto Mboto “Improving the Routine HMIS in Nigeria through Mobile Technology for Community Data Collection”, *Journal of Health Informatics in Developing Countries*, Vol 7, No. 1. (2013)
- Phillips, James F., Elizabeth F. Jackson, Ayaga A. Bawah, Bruce MacLeod, Philip Adongo, Colin Baynes, and John Williams “The Long-Term Fertility Impact of the Navrongo Project in Northern Ghana”, *Studies in Family Planning* 43[3]: 175–190 (2012)
- MacLeod, Bruce, James Phillips, Allison Stone, Aliya Walji, John Koku Awoonor-Williams 2012 “The Architecture of a Software System for Supporting Community-based Primary Health Care with Mobile Technology” *Online Journal of Public Health Informatics*, Vol 4 No 1 (2012)
- Hartsock, Brian, MacLeod, Bruce, Roberge, David and Asangansi, Ime 2011 “Software Extensibility Strategies for Health and Demographic Systems in Low-Income Countries” Proceedings of IEEE Global Humanitarian Technology Conference, Seattle WA.
- Bawah, Ayaga A., James F. Phillips, Martin Adjuik, Maya N. Vaughan-Smith, Bruce B. MacLeod, and Fred N. Binka. 2009. “Immunizations, poverty and child survival in Kassena-Nankana District of northern Ghana.” *Scandinavian Journal of Public Health* February 2010 vol. 38 no. 1 95-103.
- Klungsoyr, Jorn, Thorkild Tylleskar, Bruce MacLeod, Paul Bagyenda, Weiqin Chen, Peter Wakholi. 2008. "OMEVAC - Open Mobile Electronic Vaccine Trials, an interdisciplinary project to improve quality of vaccine trials in low-resource settings.", Proceedings of 1st International Conference on M4D Mobile Communication Technology for Development, Karlstad University. Sweden.
- Klungsoyr, Jorn, Peter Wakholi, Bruce MacLeod, Alberto Escudero-Pascual, Neal Lesh. 2008. "OpenROSA, JavaROSA, GloballyMobile - Collaborations around Open Standards for Mobile Applications.", Proceedings of 1st International Conference on M4D Mobile Communication Technology for Development. Karlstad University. Sweden.
- Binka, Fred N., Ayaga A. Bawah, James F. Phillips, Abraham Hodgson, Martin Adjuik, Bruce MacLeod. 2007. “Rapid achievement of the child survival Millennium Development Goal: Evidence from the Navrongo Experiment in northern Ghana.” *Tropical Disease and International Health* Volume 12, Issue 5 Page 578-593, May 2007.
- MacLeod, Bruce and James Phillips, 2001 “Next generation Data Systems for Longitudinal Health and Demographic Studies” paper presented at the National Academy of Sciences workshop on “Leveraging Longitudinal Data”, Washington DC, July, 2001.
- Ngom, Pierre, Fred N Binka, James F Phillips, Brian Pence, and Bruce MacLeod 2001 “Demographic surveillance and health equity in sub-Saharan Africa” *Health Policy and Planning* 16: 337-344.
- MacLeod, Bruce. 2001. Results of collaboration fostered by a network technical working group, 1st INDEPTH conference in Tanzania, 2000 and at the second INDEPTH conference in South Africa, 2001

- Phillips, James F, MacLeod, Bruce B., Pence, B. 2000 “The Household Registration System: Computer Software for the Rapid Dissemination of Demographic Surveillance Systems”, Demographic Research [online] 2, : <http://www.demographicresearch.org/Volumes/Vol2/6>
- Binka, Fred N., Ngom, Pierre, James F. Phillips, Kubaje Adazu, and Bruce B. MacLeod. 1999. "Assessing population dynamics in a rural African society: The Navrongo Demographic Surveillance System," *Journal of Biosocial Science*, Vol 31, Issue 3.
- MacLeod Bruce, James F. Phillips., and Fred Binka. 1996 “Sustainable Software Technology Transfer : The Household Registration System” in *Encyclopedia of Microcomputers*, Vol 17, Editors Allen Kent and James Williams, Marcel Dekker, Inc, New York.
- MacLeod Bruce, James F. Phillips., and Fred Binka. 1996 “Sustainable Software Technology Transfer : The Household Registration System” *Encyclopedia of Library and Information Science*, Vol 58, Editors Allen Kent and James Williams, Marcel Dekker, Inc, 1996
- Mahesh Girkar, Bruce MacLeod, and Robert Moll, “Performance Bounds for Bottom-Left Guillotine Packing of Rectangles,” *Journal of the Operational Research Society*, Vol 43, No. 2, 1992, Pgs 169-175.
- MacLeod, Bruce and Robert N. Moll, “A Principled Approach to Solving Complex Discrete Optimization Problems,” *Computer Science and Operations Research: New Developments in their Interfaces*, 1992. Pergamon Press (U.K.).
- MacLeod, Bruce, David Leon, and James F. Phillips, “The Household Registration System : A Database Program Generator for Longitudinal Studies of Households,” *Social Science Computer Review*, Fall 1992, Duke University Press.
- Bailey, Duane, Janice Cuny, and Bruce MacLeod, “Reducing communication overhead: A parallel code optimization”, *Journal of Parallel and Distributed Computing*, Vol 4, Issue 5, October 1987

PRESENTATIONS AND INVITED TALKS

- MacLeod, Bruce, November 2015, “Developing mobile health applications is hard, and getting harder : MOTECH and the CIMS “ Invited talk at the University of Bergen, Bergen Norway.
- MacLeod, Bruce, May 2012, “Cross River Health and Demographic System(CRHDS)” Presentation to the Nigerian Ministry of Health and the NEHSI Project Advisory Committee, Abuja Nigeria
- Awoonor-Williams, James F. Phillips, Allison Stone, Stephane Helleringer, Bruce MacLeod, Ernest Opoku, Jemima Frimpong, and Margaret Schmitt. 2011 “The Mobile Technology for Community Health (MoTeCH) Initiative: An m-Health System Pilot in a Rural District of Northern Ghana. Presentation at the 2011 American Public Health Association Annual Meeting/Working Paper.

- Roberge, David, MacLeod, Bruce, Hartsock, Brian and Asangansi, Ime, 2011 "Mobile Devices and Health Systems" Poster presentation at the Proceedings of IEEE Global Humanitarian Technology Conference, Seattle WA
- MacLeod, Bruce, March 2011 "The Mobile Technology Community Health Initiative" Invited talk at Columbia University, New York, NY.
- MacLeod, Bruce, March 2011 "MoTECH: Using Mobile Phones to Improve Health in Ghana", Presentation at the University of Maine, Orono.
- MacLeod, Bruce, February 2011 "Extensibility Elements of MoTECH", Presentation at the India office of the Bill and Melinda Gates Foundation, New Delhi, India
- MacLeod, Bruce, December 2010 "MoTECH: Using Mobile Phones to Improve Health in Ghana", Presentation at the Annual TechMaine Conference, Portland, ME.
- MacLeod, Bruce, June 2010, Guest Lecturer for the Electronic Mobile Data in Health Research Ph.D course at the Bergen Summer Research School on Global Development Challenges, Bergen Norway.
- MacLeod, Bruce, December 2009 "Mobile Technology for Community Health (MoTECH) A Technical Perspective" Presentation at the Bill and Melinda Gates Foundation, Seattle WA.
- MacLeod, Bruce, Jorn Klungsoyr, 2008. "EpiHandy, JavaRosa and Mobile Computing for Public Health", 2nd International Conference for Application of Mobile Computing Devices in Global Health. Center for Disease Control, Atlanta, Georgia
- Franks, Richard, Bruce MacLeod, David Briggs, Lewis Incze, Nicholas Wolff, Dynamic Approach to Integrating Oceanographic and Biogeographical Data in the Gulf of Maine'. Ocean Biodiversity Informatics Conference, Dartmouth, Nova Scotia, October 2007.
- MacLeod, Bruce, 2006, "Technical Innovations and Reducing DSS Cost", 6th Annual General Meeting of the INDEPTH network, Ouagadougou, Burkina Faso
- MacLeod, Bruce, 2005, "Improving Data Quality at DSS Sites", 5th Annual General Meeting of the INDEPTH network, Durban, South Africa
- MacLeod, Bruce, James Phillips, 2002 "Appropriate Software Technology for Longitudinal Health Studies" paper presented at a workshop on Software Generation at the International Conference on Software Reuse. Austin, Texas, April, 2002.
- Phillips, James F. and Bruce B. MacLeod. 1998. "The Household Registration System: Computer software for the rapid dissemination of demographic surveillance systems," paper prepared for the Team Residency on Longitudinal Community-Based Health Research (LCHR), Bellagio, Italy February 2-8, 1998.
- Phillips, James F., Fred Binka, Pierre Ngom, and Bruce MacLeod. 1997. "The Navrongo Demographic Surveillance System in northern Ghana: A resource for experimental studies in health and family planning," paper presented at the IUSSP Seminar on Methods for the Evaluation of Family Planning Programme Impact, Jaco, Costa Rica (May 14-16).
- Binka, Fred N., Pierre Ngom, James F. Phillips, Kubaje Adazu, and Bruce B. MacLeod. 1997.

"Assessing population dynamics in a rural African society: The Navrongo Demographic Surveillance System," paper presented at the IUSSP General Population Conference, Beijing, China (October 11-17).

MacLeod, Bruce. Results of collaboration established by an INDEPTH technical working group at the "Strengthening Ties: The Agincourt field site in its African Context" conference, April 1997, London School of Tropical Medicine, London England.