

Timothy M. Kowalewski

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Education

2006 – Present PhD in Electrical Engineering *(expected Dec 2011)*

- University of Washington, Seattle, WA
- Department of Electrical Engineering, Controls and Robotics
- Advisor: Blake Hannaford, PhD (UW Engineering)
- Dissertation Title: “Real-time Quantitative Assessment of Surgical Skill”
- **Master’s Degree, Controls and Robotics, Awarded June 2009**

2003 – 2005 B.A. in Philosophy and Fine Arts *(unfinished)*

- New Westminster Abbey, SCK Mission, BC
- 4.00 Cum. GPA, (4.12 A+, Canadian System)

1999 – 2003 B.S. Electrical Engineering

- University Of Washington Seattle, WA
- College of Arts and Sciences Honors program
- Department of Engineering Honors Program
- Analog/DSP specialty with Math Minor
- 3.77 Cum. GPA “Cum Laude,” Dean’s List Recognition

Honors, and Awards

- "Best of the AUA Moderated Poster Session MP48: Technology & Instruments: Surgical Education and Skills Assessment" at the 2011 American Urological Association Conference
- “Best Doctoral Candidate Award” at the Doctoral Consortium on Surgical Robotics and Simulation hosted at the American College of Surgeons’ Accredited Education Institutes Meeting, Chicago, March 2010
- “2008 Minimally Invasive Innovations of the Year” award from the Society of Laparoscopic Surgeons for collaborative work on Simulab’s EDGE platform, 2008
- Rushmer Fellowship, University of Washington Electrical Engineering Department, 2006-2009
- First Place at Annual Oratory Contest, New Westminster Abbey Seminary, 2005
- Knights of Columbus Scholarship (2004)
- Mary Gates Scholar (2003-2004)
- D.C. Hanley Endowed Scholarship (2002)
- Kimberly-Clark Scholarship (2001)

Journal Publications

Timothy Tausch, **Timothy Kowalewski**, Lee White, Timothy Brand, Thomas Lendvay, *Content and Construct Validation of a Robotic Surgery Curriculum Using an Electromagnetic Instrument Tracker*, Journal of Urology, April 2011 vol. 185 issue 4, p.e594.

Diana C.W. Friedman, **Tim Kowalewski**, Radivoje Jovanovic, Jacob Rosen, Blake Hannaford, *Freeing the Serial Mechanism Designer from Inverse Kinematic Solvability Constraints*, Applied Bionics and Biomechanics, vol. 7, no. 3, pp. 209-216, September 2010.

H. Rashid, **T. Kowalewski**, P. Oppenheimer, A. Ooms, J. Krieger, R. Sweet, *The Virtual Reality Transurethral Prostatic Resection Trainer: Evaluation of Discriminate Validity*, The Journal of Urology, 2007, Volume 177, Issue 6, Pages 2283-2286,

Sweet, R, **Kowalewski, T**, Oppenheimer, P, Weghorst, S, Satava, R, *Face, Content and Construct Validity Of The University Of Washington Virtual Reality Transurethral Prostate Resection Trainer*. Journal of Urology. 172(5, Part 1 of 2):1953-1957, November 2004.

Conferences

Diana C.W. Friedman, Jesse Doshier, **Tim Kowalewski**, Jacob Rosen and Blake Hannaford, *Automated Tool Handling For The Trauma Pod Surgical Robot*, IEEE Intl. Conference on Robotics and Automation, ICRA 2007, Rome, Italy.

J. Rosen, **T. Kowalewski**, C. Pugh, B. Hannaford, M. Sinanan, *Quantitative Procedural Skill Analysis Via Vector Quantization And Hidden Markov Modeling*, Studies in Health Technology and Informatics - Medicine Meets Virtual Reality, Long Beach, CA, January 2005. (Presented by Dr. Rosen)

T. Kowalewski, J. Rosen, L. Chang, M. Sinanan, B. Hannaford, *Optimization Of A Vector Quantization Codebook For Objective Evaluation Of Surgical Skill*, Proc. Studies in Health Technology and Informatics - Medicine Meets Virtual Reality 12, Newport Beach, CA, pp. 174-179, January 2004.

T. Kowalewski, Sweet, R., Oppenheimer, P., Weghorst, S., *Validation of The UW Virtual Reality TURP Simulator*. Studies in Health Technology and Informatics - Medicine Meets Virtual Reality 11. Newport Beach, CA. Conference Presentation, January 2003.

R. Sweet, **T. Kowalewski**, P. Oppenheimer, J. Berkley, J. Porter, S. Weghorst, *The UW Virtual TURP Simulator*, American Urology Association Conference, video/podium and ACMI product presentation, Orlando, Florida May 2002

R. Sweet, **T. Kowalewski**, P. Oppenheimer, J. Berkley, J. Porter, R. Satava, S. Weghorst, *Validation of the UW TURP Simulator as a Training Tool*, World Congress of Endourology, video/podium and poster, Genoa, Italy, September 2002

Posters

White LW, **Kowalewski T**, Hannaford B, Lendvay TS. *SurgTrak: Affordable Motion Tracking and Video Capture for the Da Vinci Surgical Robot*. In: Society of American Gastrointestinal and Endoscopic Surgeons, Proceedings of the 2011 Meeting of the SAGES, San Antonio, Texas. vol. 1; 2011. p. 204.

Timothy J Tausch, Timothy Kowalewski, Lee White, Timothy C Brand, Thomas S Lendvay, Content and Construct Validation of a Robotic Surgery Curriculum Using an Electromagnetic Tracking Device, Moderated Poster Session, AUA 2011, Poster#1482.

Jeremy Ridge, **Timothy Kowalewski**, Liang-Ting Jiang, Lee White, Blake Hannaford, "Exploring the Viability of CAN/CANopen for Tele-surgery: The C-arm Project", UW Mary Gates Undergraduate Research Symposium, Seattle, May 2010

Andrew S. Wright, **Timothy M. Kowalewski**, Blake Hannaford, "Novel Laparoscopic Box Trainer with Integrated Force and Positioning Sensors", 12th World Congress of Endoscopic Surgery Emerging Technology Session, National Harbor, MD, April 2010

F. Nagahisa, **T. Kowalewski**, J.Q. Le, B. Hannaford, J. Rosen, "Stepping Stones to Surgical Application of Hidden Markov Models," UW Mary Gates Undergraduate Research Symposium, Seattle, May 2003.

Articles In Submission or Preparation

David Schroeder, Daniel F. Keefe, **Timothy Kowalewski**, Lee White, John Carlis, Erlan Santos, Robert Sweet, Thomas S. Lendvay, Troy Reihsen, *Visualizing Surgical Training Databases: Exploratory Visualization, Data Modeling, and Formative Feedback for Improving Skill Acquisition*, IEEE Computer Graphics and Applications (in submission).

"Deriving optimally discriminative task space encoding for surgery via the Information Bottleneck," (in preparation)

"The Buried Markov Model in quantitative temporal analysis of surgical skill," (in preparation)

"A generalized, procedure-independent task decomposition for evaluation of surgical technical skill," (in preparation)

Invited Talks or Seminars

- **Invited seminar**, "Digital Surgery, Present and Future" **University of Minnesota Digital Technology Center**, Dec 2010
- Invited speaker, UMN Simulation Science Institute vision meeting, Aug 2010
- Invited Talk, "Neurophysiologically-Inspired Quantitative Metrics of Surgical Skill," University of Washington Institute of Simulation and Interprofessional Studies (ISIS), R&D Meeting, March 2010
- **Invited Seminar**, "Hidden Markov Modeling For Quantitative Skill Recognition," **Johns Hopkins University**, Baltimore, MD, June 2004.

- Invited Talk, "Hidden Markov Models: Introduction and Haptic Applications" UW Haptics Research Interest Group (H-RIG), HIT Lab, Seattle Washington, January 2002

Grants

Automated Support of Surgical Training, Operations, and Outcomes, Phase I

Sponsor: Dept. of Defense, US Army Small Business Technology Transfer Program (STTR)
 Funding: \$ 100,000
 Role: Primary grant author, key technical operative, liaison between surgical, small business and engineering university staff
 PI: Thomas Lendvay, MD
 Dates: Sept 2010 – Sept 2011
 Status: Active. Phase II planned up to \$750,000

EDGE Enhanced Surgical Skill Evaluation, Phase II

Sponsor: Washington Technology Center, Research Technology Development Program
 Funding: \$ 89,811, Matched by \$31,434 from Simulab Corp.
 Role: Primary grant author, inventor, key technical operative, liaison between university and Simulab Corp.
 PI: Blake Hannaford, PhD
 Dates: July 2010 – June 2011
 Status: Active. Phase III planned

EDGE Enhanced Surgical Skill Evaluation, Phase I

Sponsor: Washington Technology Center, Research Technology Development Program
 Funding: \$ 100,000, Matched by \$20,000 from Simulab Corp.
 Role: Primary grant author, inventor, key technical operative, liaison between university and Simulab Corp.
 PI: Blake Hannaford, PhD
 Dates: July 2009 – March 2010
 Status: Completed Successfully

Virtual Reality TURP Surgical Simulator

Sponsor: Mary Gates Research Endowment, Undergraduate Research Training Grant
 Funding: \$ 5,000
 Dates: 2003-2004

Intellectual Property

- **Pending Disclosure:** Computerized Surgical Skill Technology, UWC4C Ref No.: 45774

- **Provisional Patent:** “SurgTrak: Motion and video capture for tracking and evaluating robotic surgery,” Thomas Lendvay, Blake Hannaford, Timothy Kowalewski, Lee White. US Patent Application No. 61/469,495, UWC4C Ref. No. 45534.02US1, Filed March 30, 2011.
- **Patent:** “Hidden Markov Model Surgical Skill Evaluation,” Blake Hannaford, Jacob Rosen, **Timothy Kowalewski**, Patent Application No. 11/466,269 , UWTR No. 7126D; Pending.
- **Intellectual Property Assignment**, “UW VR TURP Simulator,” R. Sweet, P. Oppenheimer, D. Hendrickson, **T. Kowalewski**, S. Weghorst, UW Urology/ HIT Lab; UWTR DL-2773-3546DL, currently licensed by METI.

Teaching Experience

- EE 472 **Microcomputer Systems**, Enrollment = 35 students, Spring 2009, Teaching score: 4.2 / 5
Role: Teaching Assistant; helped design labs, corrected assignments, taught practical skills in C programming, real-time OS, and embedded systems design, ABET Evaluation
- EE 472 **Microcomputer Systems**, Enrollment = 32 students, Winter 2009, Teaching score: 4.2 / 5
Role: Teaching Assistant; helped design labs, corrected assignments, taught practical skills in C programming, real-time OS, and embedded systems design, ABET Evaluation
- EE 436 **Medical Instrumentation**, Enrollment = 18, Autumn 2008, Teaching score: 4.1 / 5.0
Role: Co-Taught with a graduate colleague, responsible for the entire laboratory component of the course, taught applied skills in analog circuit design, interface with biological and electromechanical systems, systems design, ABET Evaluation

Professional Experience

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|------------------|---|-----------------------------------|
| 2010 | Project Consultant | Spi Surgical (spisurg.com) |
| | <ul style="list-style-type: none"> • Experimental Design and grant writing for an DOD STTR, US Army • Linux-based software development for the Surgical Genome Project • Implementation of generalized skill evaluation algorithms for online skill evaluation | |
| 2009-2010 | Software Developer | Dradis Consulting |
| | <ul style="list-style-type: none"> • Designed and developed C++ software for surgical skill evaluation platform | |
| 2009 | Inventor | Intellectual Ventures |
| | <ul style="list-style-type: none"> • Submitted 10 collaborative invention disclosures for prospective patent applications | |

- 2008 – 2009 Product Development Engineer, Consultant Simulab Corp.**
- Commercialized the UW “Red Dragon” into Simulab’s Efficient Data Generation and Evaluation (EDGE) platform.
 - Worked on EDGE’s mechanical, electronics hardware, and software overhaul
 - Created and implemented data validation and system diagnostics protocols
 - Preliminary results of working VQ and Hidden Markov Model implementation for FLS tasks presented in early 2009s
 - Developed the Sonorio, FAST Ultrasound Trainer
- 2005 – 2006 Research Scientist UW BioRobotics Lab**
- Developed, tested, and installed the Tool Rack Subsystem, a fully integrated robotic sub-system for telesurgery as part of DARPA’s TraumaPod project with Stanford Research Institute (SRI).
 - Played a key role in the success of mechanical, hardware, and software system implementation in a single design, build, and test cycle.
 - Ours was the only subsystem that was developed from scratch yet it was completed on time and to spec.
- 2005 Engineering Consultant UMN Urology**
- Redesign and implementation of a sensor assembly for the Virtual Reality TURP Surgical Simulator.
 - Overhaul of and integration with new Visual C++ source code as well as embedded system coding and hardware for force-feedback integration.
 - Extensive experience with the Mimic Technologies’ “Haptic Mantis”
- 2003, 2004 Research Analyst UW BioRobotics Lab**
- Developed stochastic surgical skill identification algorithms for next-generation surgical robotic platforms and “integrated O.R.” paradigm along with related publications, resulting in an intellectual patent.
 - Implementation and modification of Vector Quantization and Hidden Markov Modeling utilizing parallel processing in cross-platform analysis.
- 2003 Research Assistant UW BioRobotics Lab**
- Analyzed/tested integrity of UW HMM MATLAB Toolkit along with its MATLAB and C competitors.
 - Led a team of RA’s in similar research and presented results the Mary Gates Undergraduate symposium.
- 2002-2003 Research Assistant UW Human Interface Technology Lab**
- Designed and developed the UW Virtual Reality TURP Surgical Simulator as part of a multidisciplinary team of scientists and surgeons, resulting in commercialized product.
 - Developed and realized experimental design, novel data collection, and statistical analysis for formal simulator validation according to clinical criteria.

- Key role in the development of the hardware used to implement the system and in porting it from SGI IRIX to MS Windows.

Service and Collaboration

- Currently collaborating with Dan Keefe, University of Minnesota Computer Science on data visualization tools for surgical data exploration
- Currently collaborating with Dr. Rob Sweet, University of Minnesota Urology, Director of SimPORTAL and CREST on the development and expansion of their surgical simulation center
- Currently collaborating with Sakti Srivastava, Stanford, on ultra-low cost medical simulators for the developing world.
- Pro bono consulting and hardware support for Madigan Army Medical Center's surgical robotic data collection with the SurgTrak platform
- Helped host and run the 2010 North American Summer School in Surgical Robotics and Simulation at the University of Washington, Seattle.

Affiliations/Memberships

- Institute for Electrical and Electronics Engineers (IEEE)
- American Association for the Advancement of Science (AAAS)
- Eta Kappa Nu, International Honors Society for Electrical Engineers (HKN)

Foreign Languages

- Polish (Native Language)