

Missael Garcia

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RESEARCH INTERESTS

My research focuses on the developing of bio-inspired polarization, multi-spectral, and hyper-spectral imaging systems for biomedical applications, specifically increasing the sensitivity and specificity of cancerous tumor detection during surgery while minimizing iatrogenic damage.

EDUCATION

Washington University in St. Louis | Ph.D. in Computer Engineering

Dec. 2017 | St. Louis, MO | GPA: 3.9/4.0

- Dissertation: Bio-Inspired Multi-Spectral and Polarization Imaging Sensors for Image-Guided Surgery.
- Advisor: Prof. Viktor Gruev.

Southern Illinois University Edwardsville (SIUE) | M.S. in Electrical Engineering

Jul. 2013 | Edwardsville, IL | GPA: 4.0/4.0

- Thesis: Buccal Prosthesis for Quadriplegic Controls.

Monterrey Institute of Technology and Higher Education (ITESM) | B.S. in Mechatronics Engineering

Dec. 2011 | Cuernavaca, Mexico | GPA: 3.9/4.0

- Graduated with honors.
- Senior Project: Robotic Gadget Designs Controlled via Smartphone.

RESEARCH EXPERIENCE

Bio-sensors Lab | Postdoctoral Researcher

Dept. of Electrical and Computer Engineering, U. of Illinois at Urbana-Champaign, Urbana, IL | Jan. 2018 - Present

- Research and development of multi- and hyper-spectral imagers for image guided surgery in patients with breast and prostate cancer. Recent developed technology has undergone clinical trials for the mapping of sentinel lymph nodes in patients with breast cancer.

Advanced Sensors Research Lab | Graduate Research Assistant

Dept. of Computer Science and Engineering, Washington U. in St. Louis, St. Louis, MO | May 2013 - Dec. 2017

- Researched and developed scientific imaging systems for polarization and near-infrared fluorescence for image guided surgery. Developed medical imaging systems underwent clinical trials at Barnes-Jewish Hospital. Tested polarization systems on the field in collaboration by multiple research groups.

TEACHING EXPERIENCE

Graduate Teaching Assistant

Dept. of Computer Science and Engineering, Washington U. in St. Louis, St. Louis, MO | Jan. 2015 - Dec 2015

- Taught and led the laboratory practices for Imaging Sensors and Digital Integrated Circuit Design and Architecture.

Dept of Electrical and Computer Engineering, SIUE, Edwardsville, IL | Jan. 2012 – Apr. 2013

- Taught and led the laboratory practices for Advanced Circuits Analysis, Electronic Design, and Computer Architecture.

Math school teacher

Kumath Institute, Cuernavaca, Mexico | Jul. 2010 – Dec. 2011

- Tutored students at high school and undergraduate levels on math, physics, chemistry, and biology topics.

State Delegate and Assistant Professor

Mexican National Mathematical Olympiad, Mexico City, Mexico | Jan. 2007 – Nov. 2009

- Trained advanced math students for the National Mathematical Olympiad.

AWARDS AND HONORS

- IEEE ISCAS Best Paper Award in the Sensory Circuits and Systems track | Florence, Italy | May 2018
- IEEE ISCAS Best Student Paper Award | Baltimore, MD | May 2017
- IEEE ISCAS Best Paper Award in the Sensory Circuits and Systems track | Baltimore, MD | May 2017
- IEEE ISCAS Best Paper Award in the Sensory Circuits and Systems track | Lisbon, Portugal | May 2015
- SIUE Outstanding Thesis Award | Edwardsville, IL | Oct. 2013
- SIUE Outstanding Graduate Student Award | Edwardsville, IL | Jan. 2013
- ITESM University's Science Fair: 1st place – Adv. Electronics and 2nd place – Comp. Science | Cuernavaca, Mexico | May 2011
- ITESM Highest single period GPA | Cuernavaca, Mexico | Jan. 2011
- ITESM Dean's List | Cuernavaca, Mexico | Held Aug. 2007 – Dec. 2011
- S. Lefschetz National Mathematical Championship for Engineers: 3rd place | Mexico City, Mexico | Apr. 2009
- ITESM Scholarship of Excellence for Undergraduate Studies | Cuernavaca, Mexico | Aug. 2007

JOURNAL PUBLICATIONS

- [1] **Garcia, M.**, Davis, T., Blair, S., Cui, N., & Gruev, V. (2018). Bioinspired polarization imager with high dynamic range. *Optica*, 5(10), 1240-1246.
- [2] **Garcia, M.**, Edmiston, C., York, T., Marinov, R., Mondal, S., Zhu, N., ... & Liang, R. (2018). Bio-inspired imager improves sensitivity in near-infrared fluorescence image-guided surgery. *Optica*, 5(4), 413-422.
- [3] Cronin, T. W., **Garcia, M.**, & Gruev, V. (2018). Multichannel spectrometers in animals. *Bioinspiration & biomimetics*, 13(2), 021001.
- [4] **Garcia, M.**, Edmiston, C., Marinov, R., Vail, A., & Gruev, V. (2017). Bio-inspired color-polarization imager for real-time in situ imaging. *Optica*, 4(10), 1263-1271.
- [5] **Garcia, M.**, Zayed, M. A., Park, K. M., & Gruev, V. (2017). Near-infrared angiography for critical limb ischemia in a diabetic murine model. *Journal of biomedical optics*, 22(4), 046006.
- [6] **Garcia, M.**, & Gruev, V. (2017). Optical characterization of rigid endoscopes and polarization calibration methods. *Optics Express*, 25(14), 15713-15728.
- [7] Marinov, R., Cui, N., **Garcia, M.**, Powell, S. B., & Gruev, V. (2017). A 4-megapixel cooled CCD division of focal plane polarimeter for celestial imaging. *IEEE Sensors Journal*, 17(9), 2725-2733.
- [8] **Garcia, N. M.**, de Erasquin, I., Edmiston, C., & Gruev, V. (2015). Surface normal reconstruction using circularly polarized light. *Optics express*, 23(11), 14391-14406.
- [9] Charanya, T., York, T., Bloch, S., Sudlow, G., Liang, K., **Garcia, M.**, ... & Achilefu, S. (2014). Trimodal color-fluorescence-polarization endoscopy aided by a tumor selective molecular probe accurately detects flat lesions in colitis-associated cancer. *Journal of biomedical optics*, 19(12), 126002.

CONFERENCE PRESENTATIONS

- [1] **Garcia, M.**, Kauffman, K., Davis, T., Marinov, R., & Gruev, V. (2018, May). A 1280 by 720 by 3, 250 mW, 24 fps Hexachromatic Imager for Near-Infrared Fluorescence Image-Guided Surgery. In *Circuits and Systems (ISCAS), 2018 IEEE International Symposium on* (pp. 1-5). IEEE.
- [2] **Garcia, M.**, Davis, T., Marinov, R., Blair, S., & Gruev, V. (2018, May). Biologically inspired imaging sensors for multi-spectral and polarization imagery. In *Polarization: Measurement, Analysis, and Remote Sensing XIII* (Vol. 10655, p. 106550C). International Society for Optics and Photonics.
- [3] **Garcia, N. M.**, Davis, T., Kauffman, K., Marinov, R., & Gruev, V. (2018, April). A Six-channel Multispectral Imager for Simultaneous In Vivo Imaging of Multiple Near-Infrared Fluorescent Markers. In *Optics and the Brain* (pp. JTU3A-3). Optical Society of America.
- [4] Gruev, V., **Garcia, M.**, Cui, N., & Li, Q. (2018, March). Bio-inspired near infrared fluorescence sensors: from the ocean to the operating room (Conference Presentation). In *Molecular-Guided Surgery: Molecules, Devices, and Applications IV* (Vol. 10478, p. 104780D). International Society for Optics and Photonics.
- [5] **Garcia, M.**, Gruev, V., Marinov, R., Kauffman, K., & Davis, T. (2018, March). Hexachromatic imager for near-infrared fluorescence image-guided surgery (Conference Presentation). In *Molecular-Guided Surgery: Molecules, Devices, and Applications IV* (Vol. 10478, p. 104780F). International Society for Optics and Photonics.
- [6] **Garcia, M.**, Zayed, M., Park, K. M., & Gruev, V. (2017, May). A 1600 by 1200, 300 mW, 40 fps multi-spectral imager for near-infrared fluorescence image-guided surgery. In *Circuits and Systems (ISCAS), 2017 IEEE International Symposium on* (pp. 1-4). IEEE.
- [7] **Garcia, M.**, & Gruev, V. (2017, February). Optical characterization and polarization calibration for rigid endoscopes. In *Endoscopic Microscopy XII* (Vol. 10040, p. 1004008). International Society for Optics and Photonics.
- [8] Gao, S., **Garcia, M.**, Edmiston, C., York, T., Marinov, R., Mondal, S. B., ... & Liang, R. (2016, April). A compact bio-inspired visible/NIR imager for image-guided surgery (Conference Presentation). In *Molecular-Guided Surgery: Molecules, Devices, and Applications II* (Vol. 9696, p. 96960A). International Society for Optics and Photonics.
- [9] **Garcia, M.**, Gao, S., Edmiston, C., York, T., & Gruev, V. (2015, May). A 1300× 800, 700 mW, 30 fps spectral polarization imager. In *Circuits and Systems (ISCAS), 2015 IEEE International Symposium on* (pp. 1106-1109). IEEE.

PATENT

Gruev, V. & **Garcia, M.** Snap shot multispectral imaging sensor. Patent filed and pending.

MEDIA COVERAGE OF MY WORK

- Inspired by the visual system of the mantis shrimp—among the most complex found in nature—we created a new type of camera that could greatly improve the ability of cars to spot hazards in challenging imaging conditions. You can read more about this work here: [Optical Society of America](#), [Interesting Engineering](#), [Science Daily](#), [Business Wire](#), [eeNews Europe](#), and others.
- We developed a bioinspired multispectral imaging sensor and clinically translated it in the operating room to assist during surgeries on patients with breast cancer. You can read more about this work here: [Fox News](#), [CNET](#), [Business Wire](#), [Science Daily](#), [Optical Society of America](#), [eHealthNews](#), [Express](#), [Daily Mail](#), [The Engineer](#), and others
- By mimicking the eye of the mantis shrimp, we have developed an ultra-sensitive camera capable of sensing both color and polarization. The work was covered by: [Discovery Channel](#), [Photonics Online](#), [Phys.org](#), [The Engineer](#), [Optics and Photonics](#), and others.

SERVICE

Reviewer

Optical Society of America A | 2017, 2018
IEEE Sensors Journal | 2017
IEEE ISCAS | 2016, 2017
Journal of Modern Optics | 2016
NGCAS | 2016
TBioCAS | 2016

Washington U. in St. Louis CSE Department Representative

Graduate Council | 2015-2016
Graduate Student Association | 2014-2015

Professional Membership

Institute of Electrical and Electronics Engineers (IEEE)
Advancing Chicanos/Hispanics & Native Americans in Science (SACNAS)

Student groups & Volunteering

SACNAS U. of Illinois at Urbana-Champaign Chapter | Outreach coordinator,
Cena y Ciencias | Outreach coordinator

SKILLS

- Matlab/Python/C/C++
 - Experience with imaging processing libraries
- Integrated Circuits design
 - CMOS/CCD image sensors
 - Camera system level research and design
- Camera calibration
 - Geometric calibration
 - Multi-dimensional signal calibration
- Computer vision and Image processing experience
- Polarization and hyper-spectral imaging experience
- Optics design
 - Optical bench experience
 - Laser optics
- Cleanroom experience
- Applied Robotics and Mechatronics
- Automation and Industrial Control
- Biomedical Research
 - Wetlab experience
 - Small animal models
 - Preclinical and Clinical studies