Master of Science in Computer Vision (MSCV)

Dr. Niels da Vitoria Lobo
Graduate Program Coordinator
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College of Engineering and Computer Science

MSCV

• Provides you:
  • Technical skills
  • Domain knowledge
  • Latest machine learning techniques
  • Practical Employment skills

• High-tech partners
  • National
    • Lockheed Martin
    • Elbit Systems
    • L3Harris
    • DRS
    • Accenture
    • SRI
  • Local partners
    • Sighthound, etc.

• Equip with you with the tools to:
  • Examine the world and solve problems.
  • Use modern technology to benefit society
  • Try for first-hand internships and networking opportunities
Highlights

#10

Computer vision at UCF has been ranked No. 10 rationally by CSRankings.org from 2010 – 2020.

5.9M

The Center for Research in Computer Vision has extensive expertise and received $5.9M in research funding last year in various areas, from video surveillance and monitoring to self-driving cars to biomedical image analysis.

22%

The demand for computer and information research scientists is expected to grow 22 percent through 2030 — much faster than other industries.

$127k

Computer and information scientists earn an annual average salary of $127K.

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Recent News Highlights

- 6 Papers accepted into ICCV 2021
- 6 Papers accepted into CVPR 2021
- ICPR 2020 - Best Scientific Paper Award
- Dr. Shah awarded $1 million grant from DARPA
- UCF Wins NIST ActEV: Activities in Extended Video Challenge at CVPR 2020
- AMiner recognized Dr. Shah with Most Influential Scholar Award Honorable Mention on AI2000
Research Areas

• Computer Vision and Natural Language Understanding
• Action and Activity Recognition
• Human Re-Identification
• Few-Shot Learning
• Crowd Analysis
• UAV Video Analysis
• Adversarial Attacks
• Geospatial Localization/Registration
CRCV YouTube Channel

https://www.youtube.com/user/UCFCRCV

- Playlists
  - Course Lectures
  - Doctoral Defenses
  - Conference Presentations (i.e. CVPR, ECCV, ICCV)
  - Guest Presentations
  - Presentations & Keynotes
  - REU 2020 & 2021
  - Tutorials (Software Installation, Python, etc.)
Career Opportunities
College of Engineering and Computer Science

Top Companies for Computer Vision Engineers in U.S.

<table>
<thead>
<tr>
<th>Company</th>
<th>Average Base Salary in 2019</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facebook Computer Vision Engineer</td>
<td>$173,745 /yr</td>
<td>$119K - $205K</td>
</tr>
<tr>
<td>Magic Leap Computer Vision Engineer</td>
<td>$149,767 /yr</td>
<td>$113K - $120K</td>
</tr>
<tr>
<td>Shiseido Computer Vision Engineer</td>
<td>$94,400 /yr</td>
<td>$80K - $85K</td>
</tr>
<tr>
<td>Apple Computer Vision Engineer</td>
<td>$160,890 /yr</td>
<td>$110K - $130K</td>
</tr>
<tr>
<td>Google Computer Vision Engineer</td>
<td>$128,428 /yr</td>
<td>$94K - $130K</td>
</tr>
</tbody>
</table>

TekPartners
3.9 ★★★★★
87 reviews
6 salaries reported

$241,744

Facebook
4.1 ★★★★★
935 reviews
14 salaries reported

$195,311

RICOMA International Corporation
2.7 ★★★★☆
8 reviews
5 salaries reported

$164,203

Magic Leap
3.3 ★★★★☆
92 reviews
7 salaries reported

$162,519

General Dynamics Information Technology
3.8 ★★★★★
7419 reviews
5 salaries reported

$145,228

Wayfair
3.1 ★★★☆☆
1455 reviews
5 salaries reported

$134,467

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CECS Virtual Grad Day
Your ONE-STOP SHOP for graduate programs
# Career Progression for Computer Vision Engineer

## Education Levels for Computer Vision Engineers

<table>
<thead>
<tr>
<th>Education Level</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Master's Degree</td>
<td>38%</td>
</tr>
<tr>
<td>Doctoral Degree</td>
<td>36%</td>
</tr>
<tr>
<td>Bachelor's Degree</td>
<td>26%</td>
</tr>
<tr>
<td>High School Diploma or GED</td>
<td>0%</td>
</tr>
<tr>
<td>Associate's Degree</td>
<td>0%</td>
</tr>
</tbody>
</table>

Based on the requirements of Computer Vision Engineer job openings on Indeed in the United States within the last three years.
MSCV Faculty
• Founding director of the Center for Research in Computer Vision at UCF.
• Research interests include: video surveillance, visual tracking, human activity recognition, visual analysis of crowded scenes, video registration, UAV video analysis, etc.
• Fellow of the National Academy of Inventors, IEEE, AAAS, IAPR and SPIE
• He is an editor of international book series on Video Computing; editor in chief of Machine Vision and Applications journal, and an associate editor of ACM Computing Surveys journal
• 124 journal publications and 265 conference publications
• Over $5.8M in research funding over the last 5 years
• 47 Doctoral Dissertations Supervised to Completion and 13 Masters Theses Supervised
Dr. Hassan Foroosh
Professor, CS

- Director of the Computational Imaging Laboratory (CIL) at UCF.
- He has authored and co-authored over 130 peer-reviewed journal and conference papers.
- In the organizing and the technical committees of several international colloquia, such as ICCV, CVPR, ECCV, ICIP, and ICPR.
- Senior member of IEEE.
- In 2004, he was a recipient of an academic excellence award from Sun MicroSystems, and the Pierro Zamperoni award from the International Association for Pattern Recognition (IAPR).
- He also received the Best Scientific Paper Award in the International Conference on Pattern Recognition of IAPR.
- His research has been sponsored by NASA, NSF, ONR, FPCE, and industry.

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Dr. Abhijit Mahalanobis
Associate Professor, CRCV

- Dr. Mahalanobis joined UCF from Lockheed Martin, where he was a Senior Fellow of the Lockheed Martin Corporation.
- His primary research areas are in Systems for Information processing, Computational Sensing and Imaging, and Video/Image processing for information exploitation and ATR.
- He has over 170 journal and conference publications in this area.
- He also holds four patents, co-authored a book on pattern recognition, contributed several book chapters, and edited special issues of several journals.
- Abhijit was elected a Fellow of SPIE in 1997, and a Fellow of OSA 2004 for his work on optical pattern recognition and automatic target recognition.
- At Lockheed Martin, he was elected to the rank of Distinguished Member of Technical Staff in 2000, and twice received the Lockheed Martin Technical Excellence award, the Author of the Year award in 2001, and the Inventor of the Year in 2005 for designing novel target recognition systems.
- In October 2005, he received the prestigious Lockheed Martin NOVA award, the Corporation’s highest honor, for putting together a National Team and a winning strategy in the FCS competition.
- Abhijit was also recognized as the 2006 Scientist of the Year by Science Spectrum Magazine, a publication of the Career Communication Group, Inc.
Dr. Nazanin Rahnavard
Professor, ECE

- Director of the Communications and Wireless Networks (CWN) Lab.
- Received NSF CAREER Award in 2011.
- Recipient of 2007 Outstanding Research Award from the Center of Signal and Image Processing (CSIP) at Georgia Tech, and her bio is listed in the 2010 edition of Who’s Who in America.
- She serves on the editorial board of the Elsevier Journal on Computer Networks (COMNET) and on the Technical Program Committee of several prestigious international conferences.
- Dr. Rahnavard is also a joint faculty in the Computer Science department and an Associate Faculty of Center for Research in Computer Vision (CRCV).
Dr. Gita Sukthankar
Associate Professor, CS

- Dr. Gita Sukthankar received her Ph.D. (2007) from the Robotics Institute at Carnegie Mellon, an M.S. in Robotics (CMU), and an A.B. in psychology from Princeton University.

- From 2000-2003, she worked as a researcher at Compaq Research/HP Labs (CRL) in the handheld computing group.

- In 2009, Dr. Sukthankar was selected for an Air Force Young Investigator award, the DARPA Computer Science Study Panel, and an NSF CAREER award.

- She is the co-organizer of the AAAI workshop series on Plan, Activity, and Intent Recognition. At UCF, she directs the Intelligent Agents Lab which focuses on three key aspects of social computational systems:
  - recognizing and predicting human intention
  - cooperation/teamwork
  - modeling group dynamics
Dr. Yanji Fu
Associate Professor, CS

• Dr. Yanji Fu received his Ph.D. degree from Rutgers, the State University of New Jersey in 2016, a M.E. degree from the Chinese Academy of Sciences in 2011 the B.E. degree from University of Science and Technology of China in 2008.

• His research interests include data mining and big data analytics.

• He has research experience in industry research labs, such as Microsoft Research Asia and IBM Thomas J. Watson Research Center.

• He has published prolifically in refereed journals and conference proceedings, such as IEEE TKDE, IEEE TMC, ACM TKDD, ACM SIGKDD, AAAI, IJCAI, VLDB, WWW.
Dr. Niels da Vitoria Lobo
MSCV Graduate Program Coordinator & Associate Professor, CS

• Received the B. Sc. (Honors) degree in Mathematics and Computer Science from Dalhousie University, Canada, and the Ph.D. in Computer Science from the University of Toronto.

• Research interests include unsupervised incremental learning, representations for visual reasoning, computer science education.
• After completing an M.S. degree in mathematical and computer sciences at Colorado School of Mines, Brian Moore earned his Ph.D. in applied mathematics at the University of Surrey in the United Kingdom in 2003.

• He held a postdoctoral research position at McGill University in Quebec, followed by a visiting assistant professorship at the University of Iowa.

• He is currently an Associate Professor of Mathematics at the University of Central Florida.

• His research interests are in numerical analysis and differential equations with emphasis on structure-preserving algorithms and lattice equations.

• His work has contributed to several scientific applications in neuroscience, material science, wave mechanics, and computer vision.
Dr. Yogesh Rawat
Assistant Professor, CRCV

• Research interests lie in the intersection of Computer Vision, Machine Learning, Social Computing, and Multimedia.

• His PhD dissertation was focused on enhancing photography experience of users utilizing social media and camera sensors. It was centered around computational media aesthetics and analysis of social media images for photography.

• He did his Postdoctoral training with Professor Mubarak Shah in the Center for Research in Computer Vision at UCF from 2017-2019.

• He obtained his BTech degree in Computer Science and Engineering from Indian Institute of Technology, IIT-BHU, Varanasi in 2009.

• Before joining NUS in summer 2012, he was working at Mentor Graphics, India, (2009-2012) with Praveen Shukla where he worked in the Veloce Emulation team.
Dr. Chen Chen
Assistant Professor, CRCV

- Research interests lie in combining Wireless Networks, Computer Vision, and Machine Learning
- Did Ph.D. University of Texas at Dallas 2016; M.S. Mississippi State University, 2012
- Current Projects:
  1) Ubiquitous Machine Vision with Adaptive Wireless Networking and Edge Computing,
  2) Democratizing AI through Multi-Hop FEDERATED LEARNING over-the-air

Research Sponsors

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Dr. Ulas Bagci
Courtesy Assistant Professor, CRCV

• Recently moved to Northwestern University but maintains a courtesy position with the Center for Research in Computer Vision (CRCV)

• His research interests are Artificial intelligence, machine learning and their applications in biomedical and clinical imaging.

• Previously, he was a staff scientist and the lab co-manager at the NIH's Center for Infectious Disease Imaging (CIDI) Lab, department of Radiology and Imaging Sciences (RAD&IS).

• At NIH, Prof. Bagci has developed and implemented educational and scientific research initiatives, and mentored postdoctoral and postbaccalaureate fellows for quantitative image analysis in clinical and pre-clinical projects at the Clinical Center.

• Prof. Bagci had also been the leading scientist (image analyst) in biosafety/bioterrorism project initiated jointly by NIAID and IRF.
Dr. Rahul Sukthankar
Google Research, Robotics Institute – CMU, Courtesy Professor, CRCV

• Distinguished scientist & senior director at Google Research
• Co-leads the Perception organization
• Stays active in the academic community with courtesy appointments at Carnegie Mellon and UCF
• Co-advises students and collaborates on open source research
MSCV Course of Study
Curriculum

Required Courses: 18 Credit Hours

- CAP 5415 Computer Vision
- CAP 6411 Computer Vision Systems
- CAP 6412 Advanced Computer Vision
- CAP 6419 3D Computer Vision
- CAP 5516 Medical Image Computing
- CAP 5610 Machine Learning

Elective Courses: 12 Credit Hours

- CAP 6908 Independent Study
- CAP 6908 Independent Study
- COT 6505 Computational Methods/Analysis I
- STA 6106 Statistical Computing I
<table>
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<tr>
<th>Year</th>
<th>Semester</th>
<th>Course #</th>
<th>Course Name</th>
<th>Credits</th>
<th>Prerequisites</th>
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<tr>
<td>1</td>
<td>Fall</td>
<td>CAP 5415</td>
<td>Computer Vision</td>
<td>3</td>
<td>COP 3503C, MAC 2312 and COT 3960</td>
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<tr>
<td>1</td>
<td>Fall</td>
<td>CAP 5610</td>
<td>Machine Learning</td>
<td>3</td>
<td>CAP 4630 or C.I.</td>
</tr>
<tr>
<td>1</td>
<td>Fall</td>
<td>CAP 5516</td>
<td>Medical Image Computing</td>
<td>3</td>
<td>MAS 3105 and COP 4020 or COT 4210</td>
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<tr>
<td>1</td>
<td>Spring</td>
<td>CAP 6411</td>
<td>Computer Vision System</td>
<td>3</td>
<td>CAP 5415</td>
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<tr>
<td>1</td>
<td>Spring</td>
<td>CAP 6412</td>
<td>Advanced Computer Vision</td>
<td>3</td>
<td>CAP 5415</td>
</tr>
<tr>
<td>1</td>
<td>Spring</td>
<td>CAP 6908</td>
<td>Independent Study</td>
<td>3</td>
<td></td>
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<tr>
<td>2</td>
<td>Fall</td>
<td>COT 6505</td>
<td>Computational Methods</td>
<td>3</td>
<td>COT 5405</td>
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<td>2</td>
<td>Fall</td>
<td>CAP 6419</td>
<td>3D Computer Vision</td>
<td>3</td>
<td>CAP 5415 or EEL 5820 or C.I.</td>
</tr>
<tr>
<td>2</td>
<td>Spring</td>
<td>STA 6106</td>
<td>Statistical Computing</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Spring</td>
<td>CAP 6908</td>
<td>Independent Study</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>
Admission

• General UCF graduate application requirements
• For admission, a 3.0 GPA and an undergraduate degree in Computer Science, Computer Engineering, and Mathematics is desirable but not required. Applicants without a strong undergraduate background in Computer Science must demonstrate an understanding of the material covered in the following undergraduate courses, by either taking these courses or by being tested on the material.

• EEL 4768C Computer Architecture
• COP 4020 Programming Languages I
• COP 4600 Operating Systems
• COT 4210 Discrete Computational Structures

• Applicants who lack background in the above courses may show knowledge in the following courses:

• CAP 4453 Intro to robot vision
• COP 3503C Computer Science II
• MAS 3105 Matrix Algebra (also need Calculus 1 and 2)
• STA 4163 Statistical Methods I
### Graduation

- 30-credit hours beyond the Bachelor’s degree
- 18-credit hours of required courses
- 6-credit hours of electives
- 6-credit hours required Independent Study with A- on projects in CAP 6908
- 3.0 GPA and must receive a B or better grade in all courses in the program
Recruiting of Ph.D. Students

- GRAs for Spring 2022

- Fellowships/GRAs for Fall 2022