Carnegie Mellon University

Master's Student Handbook

Academic Year 2026 - 2027

School of Computer Science
The Robotics Institute
Graduate Student Handbook

Masters in Computer Vision (MSCV)

Table of Contents

Welcome & Introduction 4

2. Robotics Institute Vision, Mission, and Values 5

2.1: **Vision** 5

2.2: **Mission** 5

2.3: **Values** 5

3. Degrees Offered 6

4. SCS & RI Department Personnel 6

6. Advising 9

6.1: Role of an Advisor and Advisor Assignments 9

6.2: Advisor/Advisee Collaboration 9

6.3: Review/Redress of Academic Conflicts 9

7. Graduate Degree Requirements 10

7.1: Residency Requirements 10

7.2: Registration Process 10

7.3: Required Units for Degree Attainment: **see Program Appendix** 10

7.4**:** RI Policy on Double Counting Courses 10

7.5: RI Policy for Courses Outside the Program Curriculum 10

7.6: RI Teaching Requirements/Opportunities 11

7.7: Requirements for Application/Consideration for Entry into PhD Program 11

7.8: Course Categories 11

8: RI Department Policies & Protocols 13

8.1: Department Policy for Withdrawing from a Course 13

8.2: New Policies / “Grandfather” Policy 13

8.3: Time Away from Academic Responsibilities 13

8.4: RI Department Bereavement Policy 13

Additional Travel Days 13

Process and Notification 13

Stipulations 14

Additional Leave 14

9: Grading & Evaluation: See Program Appendix 14

9.1: Satisfactory Academic Standing 14

10: Funding & Financial Support 15

10.1: Travel/Conference and Research Funding 15
10.2: Department Policy on Outside Employment 15
APPENDIX: MSCV Degree Attainment 16
A. 15
i. 15
ii. 16
iii. 16
iv. 16
B. 16
C. 17
i. 17
ii. 17
iii. 17
D. 18
E. 18
F. 18
G. 18
i. 19
ii. 19
H. 19
I. 19
MSCV Financial Policies 20
A. 20
B. 20
Scholarship/Fellowship Opportunities 20
Additional Student Information 20
Locker Rental 20
Purchasing and Reimbursement Procedures and Policies 21

Welcome & Introduction

We are proud of the open, friendly culture that has been the hallmark of the Robotics Institute (RI) since its inception. Faculty keep their office doors open to encourage informal meetings with students and colleagues. Graduate students organize department-wide social activities, ranging from Friday afternoon get-togethers to rock climbing trips. In addition, the department's strong support for collaboration creates an ideal environment for world-class robotics research.

RI is an intellectually diverse, multi-disciplinary department. Our faculty and students come from a wide variety of backgrounds and represent many unique areas of expertise. This diversity stems from the multi-faceted nature of robotics, which encompasses aspects of computer science, mechanical engineering, electrical engineering, psychology, and many other disciplines.

RI was established in 1979 to conduct basic and applied research in robotics technologies relevant to industrial and societal tasks. Seeking to combine the practical and the theoretical, RI has diversified its efforts and approaches to robotics science while retaining its original goal of realizing the potential of the robotics field.

RI is an international leader in robotics education. The world's first Robotics Ph.D. program was founded here in 1988 with the goal of providing graduate students with the knowledge, experience, and skills to become the next leaders in robotics research and education. Graduates from the Ph.D. program have taken on roles ranging from faculty in top universities, to designing and controlling Mars rovers, to developing self-driving cars. We have steadily grown and expanded our programs of study over the years.

Today, we offer diverse opportunities at all levels of education - from master's programs and an undergraduate degree to K-12 where our renowned programs, workshops, and summer classes inspire and educate the next generation of roboticists. Even when robotics technologies were relatively primitive, their ability to boost the productivity and stature of the United States was foreseen in the evolving global marketplace.

Best Wishes,

Dr. Srinivasa Narasimhan
Interim Director, Robotics Institute

While this handbook is specific to your academic experience in the department, it is just one element of the **Graduate Student Handbook Suite**. Here are several other resources within the suite that you should consult when needed:

- The Appendix for your specific program at the end of this Handbook
- University-Wide Graduate Student Handbook: Office of Graduate & Postdoctoral Affairs**>Resources**
- University-Wide Graduate Student Handbook (Office of Graduate & Postdoctoral Affairs)

- The Carnegie Mellon Student Handbook

2. Robotics Institute Vision, Mission, and Values

2.1: **Vision**

Since its founding, the Robotics Institute (RI) at Carnegie Mellon University continues to be the preeminent collaborative hub for the world's visionaries in robotics. As the pioneers of computer science-based robotics, our approach to research, development and implementation is rooted in interdisciplinarity and is guided by computational thinking, so that we may build premiere real-world solutions that serve the breadth of humanity.

2.2: **Mission**

RI brings together the top scientific minds, intent on solving humanity's toughest challenges through robotics. Encompassing the practical and the theoretical, we push the boundaries of collaboration to develop interdisciplinary solutions touching nearly every aspect of human life—making things safer, more efficient and more productive. We educate, mentor and empower the brightest and most ambitious roboticists to anticipate the future, and then to build the robotics we need to take us there.

2.3: **Values**

Every voice matters and creativity and ingenuity thrive.
All individuals are welcome. All ideas are significant. All points of view are critical. Our influence is amplified by the people who choose to be here. We cultivate sheer talent and brilliance to produce the robotics leaders the world needs.

What we build has the power to change almost anything for good.
Our sense of responsibility guides and unites us. Because we have the capabilities and technologies to offer a brighter future, it's on us to find solutions and fuel essential progress.

We're always the revolutionaries of robotics.
For decades, we've been intrepidly driving the field forward—for the betterment of society and the lives of people everywhere.

Together, even moonshots are within our reach.
At the intersection of collaboration, ambition and hard work, we believe anything is possible.

3. Degrees Offered

MS in Robotics (MSR)
MS in Robotic Systems Development (MRSD)
MS in Computer Vision (MSCV)
Doctor of Philosophy (Ph.D.) in Robotics
    Dual Degree Ph.D. Program in Robotics (CMU Portugal)
    Center for the Neural Basis of Cognition Option (CNBC)
    Students must be separately admitted to the CNBC program; they fulfill the same basic requirements as regular Ph.D. students in Robotics and have additional requirements to fulfill.
Bachelor of Science in Robotics
    Additional Major in Robotics
    Minor in Robotics

Accelerated Graduate Program: enables current Carnegie Mellon undergraduates' access to an abbreviated application for early admission to the MS in Robotics (MSR) program.

4. SCS & RI Department Personnel

As already mentioned, we are proud of the open, friendly culture that has been the hallmark of the Robotics Institute (RI) since its inception. Faculty keep their office doors open to encourage informal meetings with students and colleagues. Graduate students organize department-wide social activities, ranging from Friday afternoon get-togethers to rock climbing trips. In addition, the department's strong support for collaboration creates an ideal environment for world-class robotics research. Feel free to reach out to anyone in the RI department and/or School of Computer Science (SCS) as needed.

Key Contact	Name	Role
Dean, School of Computer Science	Martial Hebert	Dean of SCS
Associate Dean for MS Programs	David Garlan	Associate Dean level signatures
Director, RI/Professor	Srinivasa Narasimhan	Director level signatures
Director of Education, RI/Research Professor	George Kantor	Form signatures
Program Director, PhD, RI/Research Professor	David Wettergreen	
Program Director, MSR Principal Systems Scientist	George Kantor	
Program Director, MRSD Principal Systems Scientist	John M. Dolan	Internships, projects, career advising
Program Director, MSCV Associate Professor	Michael Kaess	Internships, projects, career advising
Manager, RI Education Team	Barbara Jean (B.J.) Fecich	Admissions, Advising
Academic Program Manager	Sarah Conte	MSCV, MRSD; Advising
Academic Program Manager	Angelica Bondy	MSR
Academic Program Manager	Becky Wang	PhD; Admissions, Advising
Senior Academic Coordinator	Kaylan Conner	Undergraduates
Senior Academic Service Officer	Jean Harpley	Courses, Waitlists, TA's
Administrative + Other		
SCS Help	help@cs.cmu.edu	Printing & Technology Needs
Assoc Dir Finance & Administration	Cheryl Wehrer	Administrative oversight
Senior Administrative Coordinator -	Tracy Linza	Funding coordinator
Administrative Coordinator	Christine Downey	Purchasing Assistant
RI Department Reception	Victor Valle	RI Mailroom, access to Robolounge, etc
Community Health & Well-Being	Angie Lusk	Student Affairs Liaison for SCS

5. Departmental Resources

Bulletin Boards: Students are welcome to post flyers, advertisements, etc. to any bulletin board in Newell Simon Hall (NSH) common spaces (i.e., outside of elevators). RI Graduate students may use e-mail distribution lists to communicate messages to one another. Information about email distribution lists can be found in the Roboguide.

Mail: The RI mailroom is located on the fourth (4th) floor of Newell-Simon Hall (NSH). Please follow these **Roboguide instructions for sending + receiving packages.**

Department Computer Clusters: Students should use the on-campus computing facilities offered by Computing Services. Students should adhere to the Computing Policies and Guidelines.

Copy Machine Availability: As a courtesy, RI Graduate students have access to the machine on the 4th floor of NSH. Students must use their password to log in; then they can print, make copies, scan documents, and send faxes. Any issues with the copy machine should be promptly reported to Becky Klaas. Questions about connecting to printing are to be directed to SCS Help.

Students may also use public "Andrew" printing. All campus affiliates are allotted a per-semester print quota which is debited as you print. Some locations offer color printing and special paper sizes. Instructions on installing the print drivers and other questions can be found here. General instructions for using printers and copiers can be found here.

Workspace: RI Master's Students are welcome to use the RoboLounge (NSH 1512) as well as any SCS common space in NSH and GHC. Students may also access conference rooms after hours. Students are expected to return rooms to their original condition after use. In addition, review the Graduate Student Space webpage on the RoboGuide for more details about which rooms are available for which types of activity (Ex: quiet study, eating, group meetings, etc).

Department Office/Building Security, Repairs and Services: The **SCS Building Facilities group** manages all initiatives and issues pertaining to the physical spaces occupied by the School of Computer Science, including RI. Please report any damages, needed repairs, and/or security concerns, both for routine requests and emergencies to this team.

Key/Access Card distribution and tracking: email building@cs.cmu.edu for an appointment. Valid CMU ID is required. Certain labs in SCS that handle their own key distribution. If you need a key for a lab, please verify with the lab owner/personnel first. If you are locked out of your office after-hours, CMU Police can provide access. Call 412-268-2323. Any keys received from the RI Department, for any reason during your program should be returned upon an office move, degree completion, and/or when they are no longer needed.

Access card administration
Your CMU ID card will open the exterior doors of most CMU buildings after regular business hours and on weekends and holidays. However, you may also require access to departmental corridors on certain floors within SCS buildings. Stop by GHC 4107 or submit a request to get those access privileges. The nine-digit number from your CMU ID card is required to complete this process.
Lost CMU ID Card: the HUB handles ID Card and Plaid Cash services for the entire campus community. The HUB is in the lower level of Warner Hall. Visit their website for more information.

Purchasing and Reimbursement Procedures and Policies: CMU has detailed and strict policies relating to the purchase of goods, services, equipment, etc. whether using a general ledger account, restricted accounts and grants. There are also reimbursement policies, along with tax exempt considerations.

RI & SCS Graduate Student Organizations
The Graduate Student Assembly (GSA) is the branch of student government that represents all graduate students at CMU. GSA maintains an e-mail distribution list that students can subscribe to called GSA-Happenings. Your RI GSA representatives are elected "for life", which means once elected, the Reps can stay on till they graduate with an option to voluntarily "retire" anytime. GSA does have mandatory attendance policies; if a rep fails to attend x number of meetings a year, that rep is automatically removed from the post, triggering an election in the RI Department. RI's current representatives can be found here.

Women@SCS aims to create, encourage, and support academic, social, and professional opportunities for women in computer science and to promote the breadth of the field and its diverse community.

Dec\5 is a social organization that encourages interaction between different Departments and Industry partners within SCS.

RISO is the Robotics Institute Student Organization. It organizes social events and trips, maintains the RoboLounge, and is also involved in the strategic long-term planning of RI. We encourage you to engage and volunteer with RISO as your interest and time allows. Please email RISO for more information.

Department Approach to Press and Media Relations
The Senior Director of media relations in the SCS Dean's Office, Aaron Aupperlee, is the point of contact between news media and the School of Computer Science community, including faculty, students, administrators, and staff. He can assist with strategic planning for publicity, interview preparation, and (depending on the specific project or issue) may assist in developing news stories or multimedia for the SCS website and social media channels. NOTE: **SCS at a Glance info is included in the above link**.

Department/College/University Brands and Logos
The CMU Brand
RI Department Branding and Identity information: see Roboguide

6. Advising

6.1: Role of an Advisor and Advisor Assignments

RI Graduate students are advised by their Program Director and the Program Manager. In general, the role of an advisor is to provide support. Students are fully responsible for their own academic progression and the timely meeting of requirements. Students are welcome and encouraged to seek out faculty and other resources for specific technical guidance as needed.

> **IMPORTANT:** Any faculty member accepting a Master's student advisor relationship is never financially responsible for the Master's student, except in the relatively rare cases when a research assistantship has been explicitly negotiated. PLEASE NOTE, a Master's student advisor must have a faculty appointment with RI.

6.2: Advisor/Advisee Collaboration

Your advisor's role may change over the course of your graduate studies
It can include advising on classes, research methods and processes, writing, publication process,

conference presentations, thesis writing and presentation and a job search. You and your advisor will mutually agree upon meeting frequency, meeting purpose, required meeting preparation and any other guidelines necessary to ensure a successful relationship.

Research management, time management, and work expectations
You will want to discuss these topics with your advisor(s):

- How research project assignment will be made
- Reporting requirements, including responsibility for budgets and appropriate charges
- Safety requirements in laboratories and studios
- Management of support staff- undergraduates or new graduate students,
- All publication expectations and processes- decisions of authorship lineup, writing responsibilities, determination of when a publication is ready for submission
- Faculty's responsibility for monitoring the integrity with which the research is carried out
- Your responsibility for accurate record keeping and the ethical responsibilities of your research endeavors

Attending conferences and meetings: ensure you have a clear understanding of:

- Funding resources
- Determination of submission of abstracts for presentation or publication
- How decisions will be made about who represents the research at conferences, and the protocols of representing Carnegie Mellon at conferences.

Respect and confidentiality
Remember to maintain the confidentiality of research projects and publications. All Master's students are expected to respect the principle of confidentiality among and between group members.

Communication is KEY
Maintain open lines of communication, respond to one another in a timely fashion, address conflicts respectfully and seek guidance when needed, clearly define timelines and expectations.

6.3: Review/Redress of Academic Conflicts

RI Graduate students who feel the need to address academic concerns should start with specific Program representatives and escalate as necessary.

Program Level: **Start HERE**	RI Department Level: 2nd	SCS Level: 3rd
Program Chair and Program Manager	Education Team Manager Associate Director of Education Department Director	Associate Dean: Master's Programs SCS Dean

George Kantor and **David Wettergreen** serve as ombudspersons for graduate students to assist with difficult academic or personal situations where a confidential sounding board and/or an intermediary can be helpful. Feel free to reach out to them directly. Examples of situations where students are encouraged to seek advice or assistance include:

- Difficulty in communications with advisor, particularly when those difficulties may lead to considering changing advisors or leaving the program.
- When conflict with other group members is difficult to resolve within the group.
- Issues related to diversity or the departmental climate for those in groups who are historically underrepresented in science.

- Personal concerns that interfere significantly with the ability to make timely progress in research or program requirements. These might be due to health, family, or financial challenges.

7. Graduate Degree Requirements

7.1: Residency Requirements

Students are required to complete the course requirements in their entirety at the Carnegie Mellon University - Pittsburgh campus. RI does not offer an option for distance learning. Students are required to be present on campus to complete all course requirements. In addition, U.S. government regulations require F-1 and J-1 international students to be enrolled in an in-person degree program, with in-person coursework. RI students may be enrolled in only one graduate program at a time.

7.2: Registration Process

All RI Graduate students are responsible for managing their registration via the Student Information Online (SIO) portal.

7.3: Required Units for Degree Attainment: **see Program Appendix**

7.4**:** RI Policy on Double Counting Courses

Students in an RI Graduate program are prohibited from double-counting courses. A course that has been counted towards another degree cannot be counted towards fulfilling course requirements for your Graduate Program. Courses may not count for more than one requirement within a Graduate program.

7.5: RI Policy for Courses Outside the Program Curriculum

Graduate Program curriculums are designed to occupy a student's full-time effort. Due to the intensive and collaborative nature of the program, the RI Department will not permit students to take more than the units required for program progression /degree completion. The maximum number of units permitted is set at the program level and cannot be raised. Course audits are included in the unit max, max units will not be increased to allow a student to audit a course.

7.6: RI Teaching Requirements/Opportunities

All interested RI Graduate students are required to have a certain level of fluency in English before they can instruct in Pennsylvania, as required by the English Fluency in Higher Education Act of 1990. Through this Act, all institutions of higher education in the state are required to evaluate and certify the English fluency of all instructional personnel, including teaching assistants and interns. View the full university policy here.

The fluency of all instructional personnel will be rated by Language Support in the Student Academic Success Center to determine at what level of responsibility the student can TA. In addition to administering the International Teaching Assistant (ITA) Test (a mandatory screening test for any non-native speaker of English), Language Support in the Student Academic Success Center helps teaching assistants who are non-native English speakers develop fluency and cultural understanding to teach successfully at Carnegie Mellon.

7.7: Requirements for Application/Consideration for Entry into PhD Program

7.8: Course Categories

Core Course: A core course is one that satisfies a core requirement for one or more RI degree programs (PhD, MSR, MRSD, MSCV). Core courses are offered at least once per year and offered in consistent semesters so students can plan accordingly (e.g., a core class is offered every Spring, it does not frequently switch between Spring and Fall). The course has lectures and multiple graded assessments (problem sets, quizzes, exams, projects, etc.).

Regular Course: A regular course has an established curriculum and is taught on a regular schedule, at least once every two years. The course has lectures and multiple graded assessments (problem sets, quizzes, exams, projects, etc.). If the faculty member who usually teaches a regular course is unavailable in the semester when the course is usually offered, RI will try to offer the course with a different instructor, but if one cannot be found the course will not be offered that semester. Regular courses can be used to partially satisfy the PhD specialized qualifier.

Special Topics Course: A special topics course is a new or experimental course where there is no commitment to offer on a regular basis. The course has lectures and multiple graded assessments (problem sets, projects, etc.). If the faculty member who usually teaches a special topics course is not available to teach it in a given semester, it is not offered that semester (i.e., no attempt is made by RI to find a substitute instructor). Special topics courses may be transitioned to regular courses with and assigned a permanent course number if they have been offered for two consecutive years, maintained significant enrollment, and have a commitment from the instructor to regularly offer the course. Special topics courses can be used to partially satisfy the PhD specialized qualifier.

Seminar Course: A seminar course is one that is created by an instructor in order to explore a contemporary research topic. Seminar courses may have some instructor-led lectures, but the primary activity in the course is reading, presenting, and discussing papers. Seminar courses do not have formal assessments beyond class participation. Seminar courses sometimes evolve into courses with a more formal curriculum by adding lectures and assessments. When this happens, a seminar may be converted to a special topic or regular course. Seminar courses cannot be used to partially satisfy the PhD specialized qualifier, nor are they pre-approved as electives for MSR, MRSD, MSCV programs.

Challenge Course: A challenge course is one that is created by an instructor to organize a student team to compete in an externally organized challenge program. Challenge courses may or may not have formal lectures. Challenge courses must have stated learning objectives and student performance assessments, but these can be more loosely defined than those of regular courses. Challenge courses are offered during the time when the external challenge is active and are expected to stop being offered when the challenge is completed. Challenge courses can be used to satisfy at most one course in the PhD Specialized Qualifier. In Master's programs, challenge courses may be used to satisfy at most one elective.

	Satisfies requirements	*Offer frequency*	*Curriculum*	*TAs*	*Course number*
Core Course	core	every year	lectures and assessments	normal schedule	Permanent
Regular Course	electives / specialized qualifier	at least once every 2 years	lectures and assessments	normal schedule	Permanent
Special Topics Course	electives / specialized qualifier	not offered regularly	lectures and assessments	normal schedule	Temporary, prepend “Special Topics:”
Seminar Course	not for PhD SQ; with chair approval for MS	not offered regularly	read and discuss papers	none	Temporary, prepend “Seminar:”
Challenge Course**	Limit of one as elective or SQ	offered during challenge	pursue challenge tasks	normal schedule	Temporary, prepend “Challenge:”

**Courses offered in the past that would qualify as a Challenge Course include 16-663 (F1Tenth Autonomous Racing) and 16-873 (Spacecraft Design-Build-Fly Laboratory). Going forward, eligible RI challenge courses will be identified as such in their course descriptions.

8: RI Department Policies & Protocols

8.1: Department Policy for Withdrawing from a Course

Students taking undergraduate and/or Graduate level courses must follow the procedures and deadlines indicated by the Registrar’s Office for adding, dropping, or withdrawing from courses as identified on the academic calendar. **NOTE: There is a separate calendar for doctoral-level courses.**

8.2: New Policies / “Grandfather” Policy

When policies are changed it is because the department believes the new rules offer an improvement. Currently enrolled students whose degree program is affected by a change in policy may choose to be governed by the old policy that was in place at the time of their matriculation or the new policy. In case degree requirements are changed and certain courses are no longer offered, the department will try to find some compromise that allows those students to satisfy the original requirements.

8.3: Time Away from Academic Responsibilities

RI Graduate students should not assume that their time off follows the academic calendar of courses. For

many graduate degree programs, there is an expectation that graduate students continue research during academic breaks and time away from campus, which may or may not be negotiated with the students. If there are requirements for student time beyond a typical weekday, this should be specified.

University Holidays are also student holidays, and students need to consult their faculty about coverage if they have challenges with taking time off during University Holidays. For example, if experiments are running that need to be monitored continuously, students should speak with their faculty about arrangements to take an equal number of days off at another time.

8.4: RI Department Bereavement Policy

Students are eligible for protected bereavement leave if they experience the loss of an immediate family member. "Immediate Family" includes, but is not limited to, a spouse or registered domestic partner, child/stepchild/unborn child, parent/stepparent, sibling/step-sibling, grandchild, grandparent, parent-in-law/parent of registered domestic partner, and sibling-in-law/sibling of registered domestic partner.

Under this leave, all full-time and part-time and graduate students are excused from class for at least five (5) working days for each eligible death. These days may be used non-consecutively. Full-time and part-time graduate students are also absolved of research duties while on leave and are eligible to continue receiving any uninterrupted pay related to the relevant funding support during this period if they are funded.

Additional Travel Days

In addition to the excused academic days, students may request up to three (3) additional working days of leave to account for travel considerations. Please see “Process and Notification” for more details on how to request this additional time.

Process and Notification

Arrangement and approval of leave and extension of assigned work should begin as soon as you learn of the death of a member of your immediate family. Students should notify their academic advisor, who can help coordinate with course instructors about the student’s absence on their behalf. Students should additionally contact their research advisor.

Stipulations

While this policy excuses a student from class attendance, the student remains responsible for all material covered in class and must work with each individual professor upon return to complete any required work. Graduate students are similarly expected to work with their research advisor to ensure that they get back on track with their research upon their return.

Students should also note that, while academic advisors will make every effort to assist students in getting their leave fully approved, subject to the requirements for their courses/research; whether or not the policy is followed may be subject to the discretion of the course instructor/research advisor.

Additional Leave

The total time of the bereavement leave should be agreed upon by the student and their teaching/funding professors based on their needs and circumstances, with the minimum offered time set at five (5) working days (with additional travel days as needed). Possible considerations for duration include, but are not limited to, physical recovery (in the case of additional injury or recovery after stillbirth), and accommodation for new and resultant arrangements (childcare, managing the estate of the deceased, etc.).

Should the student need leave of more than five (5) working days, or any other support, they are encouraged to reach out to RI Cares representatives in the department and/or their research advisor to work out accommodation.

9: Grading & Evaluation: See Program Appendix

9.1: Satisfactory Academic Standing

Any student who fails to achieve the minimum QPA, infringes the Academic Integrity policy, or otherwise fails to make appropriate progress toward graduation, falls out of Good Standing in the Program. Academic integrity on research papers, including a dissertation, is also enforced strictly; citations are required to avoid plagiarism, including self-plagiarism.

The first time a student falls out of Good Standing, the student is subject to Academic Probation, which serves as a warning to the student and may also trigger supportive actions on the part of the Program, such as advising meetings, reduced maximum course loads, and/or ineligibility for Research Assistantship funding.

If after one semester the student has not returned to Good Standing, or should a student fall out of Good Standing more than once during the Program, the student is subject to Academic Suspension, which is a mandatory, but temporary, leave from the University. It serves as an opportunity for the student to re-evaluate goals, reflect on the requirements for success, and return to the University better prepared to succeed.

Any student previously placed on Academic Suspension who fails to remain in Good Standing may be dismissed from the program (i.e., expelled). Dismissal indicates a complete and permanent separation of the student from the Program.

Elevated levels of misconduct, either within or outside a class, may upon recommendation by the Chair of the Program and confirmation by the RI Associate Director of Education and the RI Department Head, result in Academic Probation, Suspension, or Dismissal, potentially during a semester.

Students will receive official notice of academic actions, such as the imposition or removal of probation, in the form of a letter mailed to the “permanent address” on file with the University. The Department Head’s determination may be appealed, however, will remain in effect during the appeal. Please refer to the CMU **Summary of Graduate Student Appeal and Grievance Procedures** should you wish to appeal any/all decisions.

10: Funding & Financial Support

10.1: Travel/Conference and Research Funding

The RI Department does not provide funds for travel or conferences. Funds are available for students to attend a conference, whether as a participant or as a presenter, from GSA and the Provost’s Office. The application process is managed by the Office of Graduate and Postdoc Affairs. Students can find more information about the application process and deadlines here.

10.2: Department Policy on Outside Employment

Due to the time-consuming nature of RI Graduate Program studies, students are not advised to accept employment while enrolled in the program as a full-time student. International students must contact the Office of International Education regarding ability to hold employment.

APPENDIX: MSCV Degree Attainment

A. Course Requirements

The degree requirements for students in the MSCV Program consist of required courses, elective courses, and an internship/practicum. **To be eligible for degree certification, students must complete a minimum of 111 units of MSCV coursework as outlined in the curriculum**. Detailed course descriptions can be found through the Schedule of Classes (SOC).

i. Sequence of Courses

It is recommended that students adhere to the following course sequence.

1st Semester, Fall Term – 36 units		
Course No.	Course Title	Units
16-820	Advanced Computer Vision	12
xx-xxx	Approved Elective Course	12
10-601 *16-831*	*Introduction to Machine Learning* *Statistical Techniques in Robotics*	12*

2nd Semester, Spring Term – 36 units		
Course No.	Course Title	Units
16-621	MSCV Project I	12
xx-xxx	Approved Elective Course	12
15-663 *16-824*	*Computational Photography* *Visual Learning and Recognition*	12*

Summer Term: 3 units of CV-related internship

3rd Semester, Fall Term – 36 units		
Course No.	Course Title	Units
16-622	MSCV Project II	12
xx-xxx	Approved Elective Course	12
16-822 *16-833*	*Geometry-Based Methods in Computer Vision* *Robot Localization and Mapping*	12*

ii. Required Courses

The courses listed below are required and must be completed by all students in the MSCV program with a grade of "B-" or better. The asterisk (*) denotes that only one of the italicized courses should be chosen, and the choice may largely depend on course availability.

- Advanced Computer Vision (16-820)
- Introduction to Machine Learning (10-601) ***or*** Statistical Techniques in Robotics (16-831)
- Visual Learning and Recognition (16-824) ***or*** Computational Photography (15-663)
- Geometry Based Methods in CV (16-822) ***or*** Robot Localization and Mapping (16-833)
- MSCV Project I (16-621) and MSCV Project II (16-622)

iii. Elective Courses

MSCV students are required to complete a total of three 12-unit electives. The electives listed on the MSCV Curriculum Webpage have been pre-approved for the MSCV degree; these do not require permission from the MSCV Program Director. Courses that are not included in the list require permission from the MSCV Program Director. To petition a course for degree inclusion, the student must send an email to the MSCV Program Director & Manager that includes the course title, name of instructor, course description, and reasoning for requesting the course. With permission from the Program Director, MSCV students may be permitted to take up to 12 units of upper-level Undergraduate (XX-300/400 level) coursework for the degree. The MSCV program cannot guarantee the regularity in which electives will be offered. Students should consult the Schedule of Classes to obtain this information. Students are required to earn a grade of "B-" or better in all elective courses.

iv. Project Requirement

Students must complete a substantial 2-semester capstone project to be eligible for degree certification (16-621/16-622). Project topics will be presented at the end of the first semester at the MSCV Project Pitch event; students will be assigned to a project by the end of the calendar year. Students are expected to devote part-time effort (12 hours per week) to the project in the Spring and second Fall semester. **This project is separate from the summer internship.**

B. Internship

The MSCV curriculum requires that students engage in a CV-related Internship during the summer between the 2nd and 3rd semester. The MSCV Program office will work with industry partners in the computer vision field to identify and present internship opportunities to students.

Students will be registered for 3 units of 16-991 "Internship." The 3 units will factor into the 111-unit total required for graduation. Internships are expected to fall within the summer term as outlined by the University Academic Calendar. The internship must be relevant to CV. International students are required to obtain federal work authorization –Curricular Practical Training (CPT) – through the Office of International Education (OIE).

All interns are required to submit a final end-of-internship report documenting the work that they carried out as part of their internship. The MSCV Program Director will review the reports and assign a Pass/Fail grade at the end of the summer term.

C. Program Learning Outcomes

Upon graduation, MSCV students should be able to…

- Use basic concepts of computer vision such as sensing, image projection, feature detection, multi-view geometry, 3D reconstruction, physics of surface reflection, motion and tracking methods, scene segmentation, object detection and recognition, scene classification
- Apply mathematical concepts such as optimization, search, linear algebra, differential equations, functional approximation, and calculus of variations to solve computer vision problems
- Apply core concepts in machine learning, such as: Bayesian learning, the Minimum Description Length principle, the Gibbs classifier, Naïve Bayes classifier, Bayes Nets & Graphical Models, the EM algorithm, Hidden Markov Models, K-Nearest-Neighbors and nonparametric learning, Maximum Margin classifiers (SVM) and kernel based methods, bagging, boosting, and Deep Learning
- Use advanced techniques in computer vision related to representation and reasoning for large amounts of data (images, videos and associated tags, text, GPS locations, etc.) toward the ultimate goal of Image Understanding, including: Theories of Perception, Mid-level Vision (Grouping, Segmentation), Object and Scene Recognition, 3D Scene Understanding, Action Recognition, Contextual Reasoning, Image Parsing, Joint Language, and Vision Models.
- Delve into advanced geometry and algebraic tools in computer vision, such as: affine and projective geometry, exterior algebras, fundamental matrix, trifocal tensors, and how to apply these tools for scene reconstruction applications.
- Use optical concepts of reflection, refraction, transmission, scattering, polarization, light fields and methods, to solve computer vision problems including: compressive sensing, computational imaging as applied to computer vision problems like material understanding, geometry estimation, and image-based rendering.
- Read, understand, implement, and present advanced research papers in computer vision.
- Define and scope a capstone project and communicate with an external or internal customer and work with customer and within a team over two semesters to implement, present, iterate on the project.

D. Withdrawing/Dropping/Adding Courses

i. Withdrawing/Dropping Courses

Due to the structured curriculum of the MSCV program, it is not recommended that students drop or withdraw from courses. Students who drop/withdraw from a course should consult with the MSCV Program Director and Program Manager to confirm that this is the best option. Students will be required to make-up the dropped course at a later date.

ii. Courses Outside of the Curriculum

The MSCV curriculum is designed to occupy a student's full-time effort. Students who wish to enroll for additional courses outside of the curriculum must gain approval from the Program Director. Due to the rigorous nature of the program, the MSCV Program Office cautions students against enrolling in extra coursework. Furthermore, RI strongly discourages over-enrollment.

iii. Auditing a Course

CMU upholds strict criteria for auditing to ensure that all course seats are reserved for students who need the class to graduate. In order to audit a class, students must officially enroll in the class in SIO and submit

an audit form to the Registrar. If the MSCV Director agrees, then maximum units can be raised to permit auditing. Part-time students will be charged per unit rates for auditing a course.

E. Full-time Status and Part-time Status

The MSCV program is designed to be completed full-time in 16 months. To maintain full-time status, the student must register for a minimum of 36 units per semester. Students with fewer than 36 units are considered part-time and will be assessed tuition on a per unit basis. Students who are registered full-time as of the 10th day of classes are expected to remain full-time for the duration of the semester.

The MSCV program offers part-time enrollment at the discretion of the Program Director. The part-time candidate must apply and be accepted into the MSCV program and commit to completing the program within the statute of limitations.

F. Waiver Policy

At the discretion of the MSCV Program Director, a student may be permitted to waive a core course requirement. Waivers will be considered if…

1) the student provides sufficiently detailed descriptions of the previously taken course (syllabus, etc.),
2) the student can successfully pass the final exam in the course, as given by the course instructor, and
3) the student would be willing to successfully pass a verbal and interactive discussion/review/test on the various subjects taught in a particular course, as administered by the respective faculty instructor.

Should a student obtain a waiver for a course, he/she will still be responsible for completing 111 units. Essentially, the student would be permitted to take an approved elective in place of the core course.

G. Transfer Courses

The MSCV program does **not** allow students to transfer previously taken courses from other Universities to meet the program requirements. The MSCV courses are tailored to specific content not typically available in other courses, making it difficult to allow the transfer of previous coursework.

H. Grading Policy

The CMU grading policy is outlined on the University Grading Policy website. MSCV students will be awarded a letter grade for all required courses and electives. Students must earn a grade of “B-“or better in all courses in order for the course to count towards the MSCV degree requirements. Should a student receive a grade that is less than satisfactory in a required course, he/she will be required to retake the course at a later date. Students failing to obtain a satisfactory grade on the second attempt will be terminated from the MSCV program. Should a student receive a grade that is less than satisfactory in an elective class, he/she will be required to make up the units through another elective course.

Pass/fail grades are not permitted for formal coursework used to satisfy MSCV requirements, except that students will earn a Pass/fail grade for internship. Audit grades are not permitted for courses used to satisfy MSCV requirements.

i. Academic Standing

At the end of each semester, the MSCV Program Office will review student grades to determine if program standards are being met. Students must maintain a GPA of 3.0 or higher to retain good academic standing in the program. Students dropping below a 3.0 will be required to meet with the MSCV Program Director to develop a plan for improvement. Students failing to rise above a 3.0 in the subsequent semester will be terminated from the MSCV program.

Should a student receive a grade that is less than satisfactory in a required course, he/she will be required to retake the course at a later date. Students are responsible for paying tuition for course retakes. Students failing to obtain a satisfactory grade on the second attempt will be terminated from the MSCV program. Should a student receive a grade that is less than satisfactory in an elective class he/she will be required to make up the units through another course. Due to the sequential and interactive nature of the MSCV Capstone Course, there is not an opportunity for a retake. Any student failing to satisfactorily pass the Capstone Course will be terminated from the program.

ii. Incomplete Grades

MSCV students are expected to complete all courses during the academic semester in which the course is taken. However, if the instructor agrees, a grade of "I" (incomplete) may be given when a student, for reasons beyond his or her control, is unable to complete the coursework, but the work completed to date is of passing quality and the grade of incomplete provides no advantage to that student over other students.

In awarding an "I" grade, an instructor must specify the requirements for completing the work and designate a default letter grade that will be assigned if no further work is submitted. Students must complete the required coursework no later than the end of the following academic semester or sooner if required by prior agreement. The instructor must record the permanent grade by the last day of the examination period of that following semester. Failure to do so will result in Enrollment Services administratively assigning the default grade.

I. Switching Programs

Admission to the MSCV program does not in any way signify admission to other RI degree programs. Each of RI's graduate programs (MSR, MRSD, MSCV, PhD) are separate and have their own application steps, admission criteria, selection processes, and admission decisions. MSCV students may apply to other RI degree programs at any point in their academic career. The MSCV program should not be viewed as a preparatory program for the RI PhD program, but rather as a stand-alone degree program for those primarily interested in a professional career track.

J. Withdrawing from the MSCV Degree Program

CMU defines a withdrawal as leaving the University with no intention of returning (see Student Leave Policy). Students who wish to withdraw from the MSCV program must state their intentions in writing to the MSCV Program Director and Program Manager. The student is then required to complete the required Withdrawal form on The HUB website. The form must include **all** necessary signatures, or the process will not be completed.

Students who withdraw before completing 60% of the semester will be charged tuition based on the number of days completed within the semester. There is no tuition adjustment after 60% of the semester is completed. There is no adjustment of the media fee, transportation fee, technology fee, or student activities fee. Students needing an adjustment to the health fee must contact Student Affairs/Health Services.

MSCV Financial Policies

A. Departmental Financial Support

RI does not currently offer any financial support to MSCV students. All accepted students are expected to be fully self-supported, including tuition, fees, health insurance, and any additional costs for books, supplies, room, and board.

B. Additional Sources for Financial Support

MSCV students can apply to be a teaching assistant (T.A.) for a course. However, T.A. slots are not always available for masters students. Since T.A. positions are a required part of the Ph.D. curriculum, they are filled first by Ph.D. candidates. Any open slots not assigned to a Ph.D. student may be offered to master's students who have taken that class previously and have shown evidence of exceptional mastery of the subject. To show exceptional mastery, an MSCV student should rank within the top 20% of all students in the course. This standard will ensure that students are fully equipped to handle the extra workload of being a TA, in addition to their capstone project.

Beyond serving as a TA, part-time jobs and side projects are discouraged during the second and third semesters (the duration of the capstone project). Most summer internships are paid positions.

Scholarship/Fellowship Opportunities

Students are encouraged to identify scholarship and/or fellowship opportunities from external agencies. In particular, we encourage students to review and apply for SMART Scholarships **funded by the Department of Defense**. Students may also review the on-line information provided by the Fellowship and Scholarship Office. This website is an excellent resource for locating an abundance of information regarding available funding for students.

Additional Student Information

Locker Rental -

Students may rent a locker in NSH to store their belongings. Students should contact Sarah Conte to arrange it. RI is not liable for materials stored in lockers. Students may not store open liquid containers, perishables, flame producing objects, weapons, or live animals in the lockers. The RI Education Team staff maintains keys to all lockers and has the right to open any locker at any time as deemed necessary.

Purchasing and Reimbursement Procedures and Policies

If a student identifies the need for a tool or supply, he/she should speak to the MSCV Program Director. Any necessary purchases should be made through an appropriate administrative assistant. Students should not make MSCV purchases with personal funds without permission from the Program Director; any purchase made with personal funds are subject to sales tax. This ensures that the business purpose is relevant and reimbursable. Once the purchase is approved, the student may move forward with the acquisition. Promptly following the purchase, the student should submit the original, itemized receipt for reimbursement.