Syllabus - Future Computing with Rogues Gallery - Spring 2024

(Course number: VIP 2601/3601/3602/4601/4602/6600/6603 VWA)

The aim of the Rogues Gallery Vertically Integrated Project (VIP) class, is to train students to use novel computing architectures, tools, algorithms, and applications. Specifically, it focuses on candidate technologies for post-Moore computing and researching new ways to use these technologies.

For some more general background on VIP see the website at vip.gatech.edu and their student brochure.

- Faculty advisors: Dr. Jeff Young, Dr. Aaron Jezghani
    - Student mentors: Hiren Kumawat (neuromorphic team)
- Class time: 11-11:50 AM Wednesdays
    - Classroom: **Klaus 2446** meeting room.
- Office hours: 10:00-11:00 AM Wednesdays also via MS Teams, Zoom, or Coda 12th floor; email or use Teams for additional questions.
- A Microsoft Teams Rogues Gallery channel is also available for subteam discussion and general questions.
- This VIP has a public repository with old posters, wiki materials, and old syllabuses at https://github.com/gt-crnch-rg/fc-with-rg-vip.
    - All student notebooks are maintained on our internal wiki at https://github.gatech.edu/crnch-rg/vip-fc-rg-wiki.

Spring 2024 Notes

For this semester we are classified as a **synchronous, in-person** class. This means that we will mostly meet in-person with an online backup video session that will be used after the first class meeting. Note that we will reevaluate the nature of the course during the semester, if the institute changes their guidance for students.

While class will be recorded, the class time will always be held at the listed class time **(synchronous)** using in-person and online meetings.

Please note that in person attendance for the lecture session is not a graded aspect of this class. However, ***attendance at subteam meetings and regular notebook updates are graded and these two activities are the primary determinant of your grade***. If you are feeling ill for any scheduled session please let the advisor and/or your sub-team members know that you will be out. Please also reach out if you are having issues with any aspect of the class.

VIP does not meet during reading days, and we look for students to finalize their semester deliverables before exam week.

Class Attendance

If you are a first time student for this VIP class, we strongly request that you try to make the scheduled meeting time. Students during their second or later enrollments have more flexibility ***as long as they can make subteam meetings***. If you are not available to attend the given class time, please let the instructor know in case we can make some arrangements to help you participate.

What is required? You **must** be able to make your subteam meetings, which are typically 1-2 hours per week. If you cannot find a time to meet with the rest of your subteam each week, you may want to rethink being part of VIP as this is a key graded component of the course.

Attendance to the main class session is encouraged but not required. If you are sick, please join remotely or watch the recording after class.

Remote Instruction Best Practices (as needed)

NOTE - This section applies only to the case where we may need to hold class remotely as a backup. Here are some expectations/suggestions to help you get the most out of class.

- When possible please share your video! Please share your video when speaking/presenting.
    - Especially when you are presenting, this helps you engage with your classmates.
    - Remember that any class recordings are just shared with the class and are deleted after a semester is over! Please let the instructor know if you have any concerns - we intend that this class is a non-judgmental space for learning and doing research together.
- Please ask questions in the chat during class
    - If the instructor asks a question it's ok to type an answer if you're nervous about speaking.
- Use our Teams groups (or your favorite alternative)
    - We have a Teams group set up for each subteam. While Teams may not be your favorite chat app (GT sadly doesn't support Slack), it's a low overhead way to sync with your subteam members
- If you lose Internet connectivity during class
    - We have phone options to join without video sharing which are perfectly suitable to use.
    - Alternatively, you can send an email or Teams message to the instructor and catch up with the video when it gets posted.
- If the instructor loses Internet connectivity during class
    - Please wait 5 minutes and check your email for any updates
    - If the instructor is not able to resume class in a timely fashion (~5 minutes) the class will be ended early for that day's session.

Learning Objectives

As part of this class, you will learn about three to four different types of "post-Moore" technologies at a high level, and you will investigate one area in more detail via directed research. Currently our sub-teams are looking at **near-memory, neuromorphic, reconfigurable, and quantum computing**. You'll learn about each of these areas, and we will discuss tools to more effectively map applications to novel architectures. Additionally, we will cover general research strategies and techniques that are applicable to a wide variety of traditional and post-Moore computing platforms.

Besides these technical topics, VIP projects have these overall learning goals:

- Learn and practice professional skills (*in our case, using remote systems and development tools like Git, VNC, and debuggers*)
- Make substantial contributions to the team project (*i.e., making progress towards improving a specific area like code, testing, documentation, or background research*)

Class Schedule and Topics

Here is a tentative list of topics we will cover. Note that the syllabus topics may change throughout the semester as this is a research-focused class.

- Week 1 (1/10): Introductions and overview; notebooks and grading
  - **Assignment**: Sign up for a sub team; brainstorm subteam meeting times
- Week 2 (1/17): Discussion of the research process and goal setting for each team
  - **Assignment**: F23 Introspection and S24 Goal Setting
- Week 3 (1/24): Using Git for notebook updates; RG tools and VMs
  - **Assignment**: Github notebook established; Access the Rogues Gallery and test out SSH/Open OnDemand
- Week 4 (1/31): Review Slurm scheduling
  - **Assignment**: Job submission and debug walkthrough
- Week 5 (2/7): Review Python virtual environments
  - **Assignment**: Python virtual environments with Slurm
- Week 6 (2/14): Hacking Day
  - **Assignment**: Self-evaluation of notebooks
- Week 7 (2/21): Effective machine learning on Rogues Gallery
  - **Assignment**: Peer evaluations
- Week 8 (2/28): Using Containers
  - **Assignment**: Container execution on the Rogues Gallery
- Week 9 (3/6): Performance and power benchmarking
  - **Assignment**: Profiling DGEMM
- Week 10 (3/13): Hacking Day
  - ***Withdrawal deadline is March 13th***
- Week 11 (3/20): ***Spring Break (no class)***
- Week 12 (3/27): Hacking day
- Week 13 (4/3): State of the art: neuromorphic and AI
- Week 14 (4/10): Hacking day
- Week 15 (4/17): Poster presentations; ***peer evaluations open***
- Week 16 (4/24): Peer evaluations due; ***no class due to finals***; finalize notebooks by end of exams

Assignments and Grading

The premise of VIP is teams working on research projects. Much like a real-world team, individual members work on different aspects of the project. Team members range from sophomores through graduate students, from first-time participants to students who have been involved for four or more semesters. The number of credits for which a student is enrolled is taken into account in grading.

Your grade is based on three areas, along with three requirements. Although each student might contribute in different ways, you must demonstrate achievements in all three areas below.

1. Documentation and records (33%)
   a. VIP Notebook (***not optional***);
   b. VIP Wiki/blog documentation;
   c. Code (via GT GitHub) if team is developing software.
2. Personal accomplishments and contributions to your team's goals (33%)
   a. Learning modules and reports required by your advisor(s);
   b. Engagement in the project; ***peer evaluations are used to determine if you participated with your subteam***
   c. Pursuit of knowledge necessary for the project;
   d. Contributions to the technical progress of the team;
   e. For more experienced members of the team, contributions to the management of the project may be expected.
3. Teamwork and interaction (33%)
   a. Peer Evaluations ***(not optional)***;
   b. On-time attendance in meetings;
   c. Actively contributes to overall team goals;
   d. Coordinates activities with other team members;
   e. Assists other team members;
   f. Team presentation(s). ***Typically, this is one slide per team per week and one poster presentation at the end of the semester.***

As part of the assessment of the above, each student is required to:

1. Maintain a VIP notebook. Scans of well-maintained VIP notebooks are available on the VIP website.
   - ***Each student must understand that if work is not documented in their VIP notebook, "Then you didn't do it," (i.e. work that is not documented in the notebook will not count toward your grade).***
2. Complete the mid-term peer evaluation. This is a web-based form, and links are available on the VIP website. ***Failure to complete the peer evaluation will result in a full letter grade deduction. Late submissions are not accepted.***
3. Complete the final peer evaluation, which will be available for one week during the week preceding finals. ***Failure to complete the peer evaluation will result in a full letter grade deduction. Late submissions are not accepted.***

Performance assessments will be done once at mid-terms and again at the completion of the semester. The mid-term assessment is advisory. The following image shows an example of the grading criteria used by the VIP program. Not all fields are utilized, but you should focus on notebook maintenance as well as team and sub-team meeting attendance.

Documentation

- Notebook Maintenance
- To Do Lists
- Meeting Notes
- Usability
- Overall Design Notebook Evaluation
- Wiki Content Quantity
- Wiki Content Quality
- SVN code logged frequently
- Code Quality
- **Overall Documentation**

Accomplishments and Effort

- Tutorials and Learning Modules
- Team and sub-team quizzes
- Papers and Technical Articles
- Pursues Independent Learning
- Self Motivated
- Independent Effort
- Quality of Effort (results)
- **Overall Effort**

Teamwork and Interaction

- Team meeting attendance
- Team meeting participation
- sub-team meeting attendance
- sub-team meeting involvement
- Contributes useful ideas
- Recognizes others ideas
- Focuses effort on achieving goals
- Involves others in effort
- Assists others with their efforts
- Manages time and tasks well
- Leadership skills
- Final Presentation
- Peer Evaluations
- **Overall Teamwork Evaluation**

OVERALL GRADE (final eval):

Individual Comments:

Notes on documentation.

Category	Description
Notebook	Your VIP wiki subpage
To-do list	Check-box lists, including date when item is complete
Meeting notes	Collective Wiki page with meeting summaries
Usability	How useful is the notebook to future students?

| Overall | Overall rating (e.g., detailed design notes, decisions, code references, website links)
| GT GitHub | Frequency, quantity, and quality of contributions |

Academic honesty

The main principle in VIP academic honesty is that you will not present someone else's work as your own. Tests and specific assignments (homework, lab assignments, etc.) must be your own work. For other work you are encouraged to consult whatever sources are helpful in learning and understanding the issues associated with the material, but you should always provide appropriate references and citations where such material is included in your VIP notebook, programming code, presentations, etc.

Additionally, to provide a good working environment for all students, you're expected to adhere to rules given here, posted, or disseminated in class. Academic Honesty is taken seriously and failure to follow these principles will result in disciplinary actions as stated in the Student/Faculty Handbook.

Accommodations for students with disabilities

Georgia Tech offers accommodations to students with disabilities. If you need a classroom accommodation, please make an appointment with the Office of Disability Services (www.disabilityservices.gatech.edu). If you have an accommodation letter from ODS, please provide your team advisor with a copy of your accommodation letter and discuss with them how your accommodations will be applied. This should be done as early as possible in the semester.

Additional resources for students

The Canvas site also has a PDF entitled "Student Resources for Support" that has a list of campus services for academic and personal issues that may come up during the semester. Please reach out to your instructor for any class-related issues that you may encounter. For personal issues, he may direct you to the appropriate campus resource to provide you with the best level of support.

What should I know already?

(Prerequisites.)

You should have at least an undergraduate-level understanding in the following topics. You'll have about a month at the beginning of the course to get up to speed on this material if you have any gaps or haven't touched these subjects in a while.

- Programming proficiency in a "systems-oriented" programming language, like C, C++, Fortran, Rust, or equivalent.

Will I need school supplies?

(Books, materials, equipment, labs, and facilities.)

Due to our remote nature, you will mainly need your personal computer and an Internet connection. A web camera is strongly suggested but not required.

VIP Labs and facilities. VIP has rooms and equipment that are shared by many VIP teams. To provide a good working environment, the following rules apply to anyone with access:

1) The room priorities are:
a. Scheduled team meetings, lectures, and learning modules;
b. Weekly sub-team meetings (multiple groups can use rooms at same time);
c. Video conferences or special meetings with VIP stakeholders;
d. Other project-related work (multiple groups can use rooms at same time).

Room schedules can be viewed on the VIP website.

While the above priorities indicate which events take precedence, a good neighbor policy on using the rooms applies. If you need to access computers, equipment, or work on a project in the room while other activities are going on (sub-team meetings, etc.), you are welcome to do so as long as it does not disrupt a scheduled activity. Similarly, multiple groups may use a VIP room at the same time. Also, where it does not disrupt one of the above uses, VIP participants may use the rooms for other activities such as studying.

2) Everyone is expected to pitch in to keep the rooms clean. Food is allowed in the rooms provided any spills or messes are cleaned immediately. The rooms are monitored by camera, and staff will pull videos to identify offenders. Gum is a particular problem especially in carpeted rooms. Do not place used gum anyplace other than in a trash can.

3) The rooms have equipment both for general use and for specific teams. General use equipment includes the projector in Klaus 1440, and monitors in VL 465 ad VL 463B. Other equipment may be for general use or dedicated to a team specific purpose; some equipment may be general use one semester and assigned to a team another semester. If you are unsure of whether equipment is available for general use, contact the VIP trouble-ticket system at vip-request@ece.gatech.edu. You should only use equipment for the designated purpose. Some equipment may pose personal hazards if used inappropriately!
a. Equipment owned by the VIP Program may not be removed from a VIP room without completed an equipment loan agreement, which would need to be approved by one of the VIP Directors. To request permission, email vip-request@ece.gatech.edu.
b. You will be responsible for the replacement cost of any equipment not returned in good condition.
c. You must be sure you know how to operate the equipment safely. Written approval to use the equipment does not indicate that the team advisor has reviewed equipment use and safety. You are responsible for knowing the hazards and safe operation of any equipment you use.

4) Computer accounts are issued for your use only. You may not share computer accounts with anyone else, even another team member. All computer usage is subject to rules and policies of Georgia Tech, the University System of Georgia Board of Regents, and the State of Georgia. Additionally, you are expected to be considerate of other users. Computer permissions are not authoritative. For example, just because you have file access to something does not indicate that it is appropriate for you to read or modify that file.

5) Buzz-card access to VIP facilities is a privilege contingent on abiding by the above rules. Buzz-card access is logged, and rooms are video recorded. Be aware that if there is a problem (theft, vandalism, or simply a mess left in a room), the logs and video records will be consulted. Do not allow unknown people to access VIP facilities. Be sure to secure the facilities (i.e. close the door) when you leave.

About VIP

This VIP course is part of a larger program, which aims to expose students to research and development (R&D). Undergraduate students that join VIP teams earn academic credit for helping in design and discovery efforts that assist faculty and graduate students with R&D issues.

The teams aim to be:

- *Multidisciplinary* - drawing students from all disciplines on campus;
- *Vertically integrated* - maintaining a mix of sophomores through Ph.D. students each semester;
- *Long-term* - each undergraduate student may participate in a project for up to three years and each graduate student may participate for the duration of their graduate career.

There are several reasons behind the design of VIP teams.

- To provide the time and context necessary for students to learn and practice many different professional skills, make substantial contributions to the project, and experience many different roles on a large, multidisciplinary VIP team.
- To support long-term interaction between graduate and undergraduate students on the team. The graduate students mentor the undergraduates as they work on VIP projects embedded in the graduate students' research.
- To enable the completion of large-scale projects that are of significant benefit to faculty members' research programs.