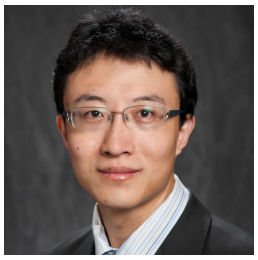
College of Performance, Visualization and Fine Arts

VIST 489 Syllabus

Section 506 (59000)
Special Topics in...
Spring 2026 - College Station

Credit Hours: 3

Instructor Details



Jian Tao
Email: jtao@tamu.edu
Office Location: ARCA 314
Phone: 9798452030

Office Hours
4:00PM - 5:00PM (Friday)
Preferred Contact Method
Email
Biography
https://tx.ag/jtao

Catalog Description

Special Topics in... Credit 1 to 4. Selected topics in an identified field of visual studies. May be repeated for up to 9 credit hours. Prerequisite: Approval of instructor and undergraduate program coordinator.

Additional Course Details

GPU architecture and programming, differences between GPUs and traditional CPUs in parallel computation. CUDA (Compute Unified Device Architecture) programming model, including memory hierarchy, execution model, and thread management; analyzing and improving GPU application performance. Implementation of parallel programming techniques essential for writing efficient GPU programs. Memory optimization, kernel optimization, and resource management strategies to enhance CUDA application performance. Solving real-world problems in image processing, numerical simulations, and deep learning. Development and optimization of CUDA programs capable of analyzing and improving GPU application performance, advanced CUDA features for efficient parallel processing.

Course Prerequisites

Prerequisite/Corequisite(s): Approval of instructor and undergraduate program coordinator.

Course Learning Outcomes

Upon completion of this course, the learner will be able to:

- Explain the architecture of GPUs, focusing on aspects such as parallel processing capabilities and memory hierarchy.
- Develop CUDA Programs: Write and debug CUDA programs to implement parallel algorithms, demonstrating proficiency in using CUDA's programming model and API.
- Optimize GPU Performance: Analyze and optimize GPU applications by applying techniques such as memory management, kernel optimization, and efficient use of resources to enhance performance.
- Apply Parallel Programming Techniques: Utilize various parallel programming techniques and patterns to solve computational problems effectively on GPU platforms.

- Solve Real-World Problems: Implement GPU-based solutions for real-world applications in areas such as scientific computing, data analysis, and machine learning, showcasing the practical application of GPU programming skills.
- Utilize Advanced CUDA Features: Leverage advanced features of CUDA, such as streams, events, and shared memory, to improve the efficiency and scalability of GPU applications.
- Evaluate and Improve Code Efficiency: Critically assess the performance of CUDA programs and make informed decisions to improve code efficiency and execution speed.

Special Course Designation

None

Textbook and/or Resource Materials

This material Is: Optional
CUDA Programming: A Developer's Guide to Parallel Computing with GPUs
Authors: Shane Cook
URL for Resource: https://www.amazon.com/CUDA-Programming-Developers-Computing-Applications/dp/0124159338
Notes:
This book provides an in-depth introduction to CUDA programming, covering fundamental concepts and advanced techniques for optimizing GPU applications.

This material Is: Optional
Programming Massively Parallel Processors: A Hands-on Approach
Authors: David B. Kirk and Wen-mei W. Hwu
URL for Resource: https://www.amazon.com/Programming-Massively-Parallel-Processors-Hands/dp/0124159923
Notes:

This textbook offers a practical approach to understanding parallel programming with GPUs, focusing on both theory and hands-on exercises.

This material Is: Optional
CUDA by Example: An Introduction to General-Purpose GPU Programming
Authors: Jason Sanders and Edward Kandrot
URL for Resource: https://www.amazon.com/CUDA-Example-Introduction-General-Purpose-Programming/dp/0131387685
Notes:
This book introduces CUDA programming through examples, making it accessible for beginners and providing practical insights into GPU computing.

This material Is: Optional
NVIDIA Developer Zone
URL for Resource: https://developer.nvidia.com/
Notes:
Provides official documentation, tutorials, and forums for CUDA developers, offering a wealth of information and support for learning and troubleshooting.

This material Is: Optional
CUDA Toolkit Documentation
URL for Resource: https://docs.nvidia.com/cuda/
Notes:
The official documentation for the CUDA Toolkit, which includes guides, API references, and best practices for developing CUDA applications.

This material Is: Optional
Existing University Courses
URL for Resource: https://developer.nvidia.com/educators/existing-courses
Notes:
This page has online courses to help you get started programming or teaching CUDA as well as links to Universities teaching CUDA.

Grading Policy

The final grade for this course will be determined based on the following components:

- Assignments (60%):
    - Regular assignments will be given throughout the course to reinforce the concepts covered in lectures and labs. These assignments will involve practical CUDA programming tasks and problem-solving exercises.
    - Each assignment will be graded based on correctness, efficiency, and code quality.
- Projects (30%):
    - Students will complete one project that requires applying CUDA programming skills to solve real-world problems. Projects will be assessed on creativity, implementation, and demonstration of understanding of GPU programming concepts.
    - A project proposal, final report, and presentation will also be part of the project grade.
- Quizzes (10%):
    - Short quizzes will be administered periodically to assess understanding of key concepts and ensure students are keeping up with the material.
    - Quizzes will cover both theoretical and practical aspects of CUDA programming.
- Grading Scale:

    A = 90-100

    B = 80-89

    C = 70-79

    D = 60-69

    F = <60

Late Work Policy

Work submitted by a student as makeup work for an excused absence is not considered late work and is exempt from the late work policy (Student Rule 7).

Course Specific Late Work Policy

In order to maintain fairness and ensure that all students have equal opportunities to succeed, the following late work policy will be enforced for all assignments, projects, and other coursework:

- Late Submission Penalty:
    - Assignments and projects submitted after the deadline will incur a penalty of 10% of the total possible points for each day late.
    - The maximum penalty will be applied after 3 days, at which point the work will receive a 30% deduction from the total possible points.
- Maximum Late Period:
    - Submissions will not be accepted more than 3 days past the original deadline unless prior arrangements have been made with the instructor.
- Extensions:
    - Students may request an extension for an assignment or project due to extenuating circumstances (e.g., illness, family emergency). Requests must be made in writing and approved by the instructor before the original deadline.
- Grace Period:
    - A grace period of 1 hour past the deadline is provided to account for any technical issues or last-minute problems. Work submitted within this grace period will not incur a late penalty.
- Technical Issues:
    - It is the student's responsibility to ensure that work is submitted on time, even in the event of technical difficulties. Students are advised to

back up their work and submit assignments well before the deadline to avoid last-minute issues.

Course Schedule

Week	Topics	Major Assignments
1	Introduction to GPU Computing and CUDA Overview	-
2	Setting Up the CUDA Development Environment	Set up CUDA environment
3	CUDA Programming Basics: Threads, Blocks, and Grids	CUDA basics exercises
4	Memory Management in CUDA: Global, Shared, and Constant Memory	Memory management exercises
5	Parallel Programming Concepts: SIMD, SPMD	-
6	Image Processing with CUDA: Filters and Transformations	Image processing project
7	Basic 3D Graphics Rendering with CUDA	-
8	Utilizing CUDA Libraries: CuBLAS and CuFFT	CUDA library use case
9	Advanced Rendering Techniques with CUDA	Rendering techniques assignment
10	Optimization Techniques for CUDA	Optimization techniques review
11	Real-time Physics Simulations with CUDA	-
12	Data Visualization with CUDA	Data visualization task
13	Machine Learning Basics and Using CUDA for Training	Machine learning basics exercises (bonus task)
14	Project Work and Review of CUDA Applications	-

15	Wrap up the course	Project presentation (final project report due one week later)

Additional Course Information

Your instructors will make every effort to be in class on time or to inform you of any delays or cancellations. In the unusual event that they should not arrive in class or send word by 10 minutes from the class start time, the class is officially canceled.

Technology Support

Technology Services (IT) - Main Campus

Hours: 24/7
Phone: (979) 845-8300
Email: helpdesk@tamu.edu
Call/Chat/Email/visit: https://it.tamu.edu/help

Canvas LMS Technical Support

Hours: 24/7/365
Phone: (877) 354-4821
Email: support@instructure.com

Support is available by clicking the Help button at the far left in the Canvas global navigation menu.
Canvas Resources are also linked on the home page of every Canvas course.

Learning Resources

- Coursera and edX Courses: Online platforms offering courses on GPU programming and CUDA, providing video lectures, quizzes, and projects to reinforce learning.

- Access to recent research papers and articles on GPU computing and CUDA programming can be beneficial for understanding the latest advancements and applications in the field.

University Policies

This section outlines the university-level policies that must be included in each course syllabus. The TAMU Faculty Advisory Council established the wording of these policies.

Academic Integrity Statement and Policy

"An Aggie does not lie, cheat or steal, or tolerate those who do."

"Texas A&M University students are responsible for authenticating all work submitted to an instructor. If asked, students must be able to produce proof that the item submitted is indeed the work of that student. Students must keep appropriate records at all times. The inability to authenticate one's work, should the instructor request it, may be sufficient grounds to initiate an academic misconduct case" (Section 20.1.2.3, Student Rule 20).

You can learn more about the Aggie Honor System Office Rules and Procedures, academic integrity, and your rights and responsibilities at aggiehonor.tamu.edu.

University Attendance Policy

The university views class attendance and participation as an individual student responsibility. Students are expected to attend class and to complete all assignments.

Please refer to Student Rule 7 in its entirety for information about excused absences, including definitions, and related documentation and timelines.

Makeup Work Policy

Students will be excused from attending class on the day of a graded activity or when attendance contributes to a student's grade, for the reasons stated in Student Rule 7, or other reason deemed appropriate by the instructor.

Please refer to Student Rule 7 in its entirety for information about makeup work, including definitions, and related documentation and timelines.

Absences related to Title IX of the Education Amendments of 1972 may necessitate a period of more than 30 days for make-up work, and the timeframe for make-up work should be agreed upon by the student and instructor" (Student Rule 7, Section 7.4.1).

"The instructor is under no obligation to provide an opportunity for the student to make up work missed because of an unexcused absence" (Student Rule 7, Section 7.4.2).

Students who request an excused absence are expected to uphold the Aggie Honor Code and Student Conduct Code. (See Student Rule 24.)

Notice of Nondiscrimination

Texas A&M University is committed to providing safe and non-discriminatory learning, living, and work environments for all members of the University community. The University provides equal opportunity to all employees, students, applicants for employment or admission, and the public, regardless of race, color, sex (including pregnancy and related conditions), religion, national origin, age, disability, genetic information, or veteran status.

Texas A&M University will promptly, thoroughly, and fairly investigate and resolve all complaints of discrimination, harassment (including sexual harassment), complicity, and related retaliation based on a protected class in accordance with System Regulation 08.01.01, University Rule 08.01.01.M1, Standard Administrative Procedure (SAP) 08.01.01.M1.01, and applicable federal and state laws. In accordance with Title IX and its implementing regulations, Texas A&M does not discriminate on the basis of sex in any educational program or activity, including admissions and employment.

The following person has been designated to handle inquiries and complaints regarding the non-discrimination policies: Jennifer M. Smith, TAMU Associate VP & Title IX Coordinator at YMCA Ste 108, College Station, TX 77843, 979-458-8407, or email civilrights@tamu.edu. For other reporting options, visit the U.S. Department of Education Office for Civil Rights Complaint Assessment System to locate the address and phone number of the office that serves your area, or call 1-800-421-3481.

Civil Rights, Free Speech, and Title IX Policies

Texas A&M University is committed to fostering a learning environment that is safe and productive for all. University policies and federal and state laws prohibit discrimination and harassment based on an individual's race, color, sex, (including pregnancy and related conditions), religion, national origin, age, disability, genetic information, veteran status, or any other legally protected characteristic. This includes forms of sex-based violence, such as sexual assault, sexual harassment, sexual exploitation, dating/domestic violence, and stalking.

Students can report discrimination/harassment, access supportive resources, or learn more about their options for resolving complaints on the University's Civil Rights & Title IX webpage.

Students should be aware that all university employees (except medical or mental health providers) are mandatory reporters, which means that if they observe, experience or become aware of an incident that they reasonably believe to be discrimination/harassment alleged to have been committed by or against a person who was a student or employee at the time of the incident, the employee must report the incident to the university.

Americans with Disabilities Act (ADA) Policy

Texas A&M University is committed to providing equitable access to learning opportunities for all students. If you experience barriers to your education due to a disability or think you may have a disability, please contact the Disability Resources office on your campus (resources listed below). Disabilities may include, but are not

limited to, attentional, learning, mental health, sensory, physical, or chronic health conditions. All students are encouraged to discuss their disability-related needs with Disability Resources and their instructors as soon as possible.

To request academic accommodations, contact the designated ADA office based on your location:

- Texas A&M University, College of Nursing, College of Dentistry, Irma Lerma Rangel College of Pharmacy College Station, College of Medicine, School of Public Health, Institute of Biosciences and Technology, EnMed Program, Bush School in Washington DC, Mays Business School – CityCentre, TAMU Engineering Academies, Texas A&M University Higher Education Center at McAllen and Texas A&M University at Galveston should contact Disability Resources at (979) 845-1637 or disability@tamu.edu.
- Texas A&M University School of Law should contact the Office of Student Affairs at (817) 212-4111 or law-disability@law.tamu.edu to request accommodations.
- Irma Lerma Rangel College of Pharmacy in Kingsville should contact the Disability Resource Center at Texas A&M University-Kingsville at (361) 593-3024 or drc.center@tamuk.edu to request accommodations.
- Texas A&M University College of Veterinary Medicine & Biomedical Sciences in Canyon should contact the Office of Student Accessibility at West Texas A&M University – Canyon at (806) 651-2335 or osa@wtamu.edu.

If you are experiencing difficulties with your approved accommodations, contact the office responsible for approving your accommodations or the Texas A&M ADA Coordinator Julie Kuder at ADA.Coordinator@tamu.edu or (979) 458-8407.

Pregnancy Accommodations

Texas A&M provides reasonable accommodations to students due to pregnancy and/or related conditions, such as childbirth, recovery, and lactation. Students should contact the University's Pregnancy Coordinator as soon as they become aware of the need for accommodation. Depending on the circumstances,

accommodations could include extended time to complete assignments or exams, changes in course sequence, or modifications to the physical classroom environment.

Texas A&M will also allow a voluntary leave of absence, ensure the availability of lactation space, and maintain grievance procedures to provide for the prompt and equitable resolution of complaints of sex discrimination. For information regarding pregnancy accommodations, email TIX.Pregnancy@tamu.edu.

Statement on Mental Health and Wellness

Texas A&M University recognizes that mental health and wellness are critical factors influencing a student's academic success and overall wellbeing. Students are encouraged to engage in healthy self-care practices by utilizing the resources and services available through University Health Services. The TELUS Health Student Support app provides access to professional counseling in multiple languages anytime, anywhere by phone or chat, and the 988 Suicide & Crisis Lifeline offers 24-hour emergency support at 988 or 988lifeline.org.

Texas A&M College Station

Students needing a listening ear can contact University Health Services at 979.458.4584. Call 911 or visit your nearest emergency room if you are currently experiencing a life-threatening situation or if your safety is at risk. 24-hour emergency help is also available through the 988 Suicide & Crisis Lifeline (988) or at 988lifeline.org.

Statement on the Family Educational Rights and Privacy Act (FERPA)

FERPA is a federal law designed to protect the privacy of educational records by limiting access to these records, to establish the right of students to inspect and review their educational records, and to provide guidelines for the correction of inaccurate and misleading data through informal and formal hearings.

Currently enrolled students wishing to withhold any or all directory information items can do so within howdy.tamu.edu using the Directory Information Witholding Form. The complete FERPA Notice to Students and the student records policy is available on the Office of the Registrar webpage.

Items that can never be identified as public information are a student's social security number, citizenship, gender, grades, GPR, or class schedule. All efforts will be made in this class to protect your privacy and to ensure confidential treatment of information associated with or generated by your participation in the class.

Directory items include name, UIN, local address, permanent address, email address, local telephone number, permanent telephone number, dates of attendance, program of study (college, major, campus), classification, previous institutions attended, degrees, honors and awards received, participation in officially recognized activities and sports, medical residence location, and medical residence specialization.

Free Speech and Civil Discourse

Texas A&M recognizes that the pursuit of truth through open and robust discourse is critical to academic inquiry. However, as a community of scholars, the university has an aspirational expectation that such discourse will be conducted in accordance with Aggie Core Values. In this "marketplace of ideas," we encourage civil dialogue creating an environment that allows individuals to express their ideas and to have their ideas challenged in respectful and responsible ways. Students can learn more about Freedom of Expression and Free Speech on the University's website about the First Amendment.