

Course Information

Course Number:	MATH 689
Course Title:	Compressive Sensing
Section:	600
Semester:	Fall 2025
Time:	MWF 9:10 – 10:00am
Location:	BLOC 121
Credit Hours:	3

Instructor Details

Instructor:	Simon Foucart
Office:	BLOC 502D
E-Mail:	foucart@tamu.edu
Office Hours:	M 8:40-9:10am, T 1:00-1:30pm, W 5:30-6:00pm, and by appointment

Course Description

Recent years have witnessed the birth of a fascinating field at the intersection of Mathematics, Engineering, and Computer Science. It is called Compressive Sensing, because of its premise that data acquisition and compression can be performed at the same time. As such, the basic objective of Compressive Sensing is to provide concrete protocols for sensing and compressing data simultaneously. This is essential when limited sensing capabilities force the reconstruction of data from sets of measurements that seem highly incomplete at first sight. It turns out that, not only is the reconstruction possible in theory, but it can also be carried out efficiently in practice. Such a conclusion is drawn from theoretical results that bring appropriate measurement schemes and efficient reconstruction algorithms to light. The course will keep an eye on the application side, but will mainly focus on the underlying mathematical theory.

Course Prerequisites

MATH 323, MATH 409, and MATH 411, or equivalent (with instructor's approval). The course is accessible to Mathematics, Statistics, Computer Science, and Engineering students alike. It assumes some basic knowledge of linear algebra, analysis, and probability. Familiarity with MATLAB is a plus.

Course Learning Outcomes

At the end of the course, students will have

- Acquired a comprehensive background allowing them to carry out research in Compressive Sensing;
- Understood the theoretical limitations inherent to sparse and low-rank recovery;
- Become familiar with probabilistic techniques used to reach these limitations;
- Been exposed to various algorithmic realizations of sparse recovery.

Textbook and/or Resource Materials

Textbook: *A Mathematical Introduction to Compressive Sensing*, by S. Foucart & H. Rauhut. Birkhauser.

Grading Policy

- Grades will be assigned on the scale A, B, C, D, F (without + or – modifiers).
- The following minimum grade is guaranteed, given the following score:
A:100%-90%, B:89%-80%, C:79%-65%, D:65%-50%, F: 49%-0%.
- The grade is based on the following items:
 - Homework (90%). Problems will be assigned weekly. Five (5) assignments will be graded. They will be collected on weeks 3, 6, 9, 12, 15 at the beginning of class on the due date. You are encouraged to come and see me during my office hours to obtain help on particular questions, provided you made a genuine attempt to solve them.
 - Class participation (10%). Although not recorded, regular attendance is expected—it is essential to do well in the course.

Late Work Policy

The graded homework assignments will be collected at the beginning of class on the due date. Late assignments will not be accepted.

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

Course Schedule

The following topics will (tentatively) be covered:

- Week 01: Applications, motivations, and extensions
- Week 02: Sparse solutions of underdetermined systems
- Week 03: Greedy and thresholding-based algorithms
- Week 04: Convex optimization
- Week 05: Basis pursuit
- Week 06: Coherence of a matrix
- Week 07: Restricted isometry property (RIP)
- Week 08: Random matrices
- Week 09: Variations on the RIP
- Week 10: Structured random matrices
- Week 11: Lossless expanders
- Week 12: High-dimensional geometry
- Week 13: Recovery of low-rank matrices
- Week 14: Recovery from one-bit measurements
- Week 15: Group testing

University Policies

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](#).)

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](#)).

Texas A&M at College Station

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

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.

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Disability Resources is located in the Student Services Building or at (979) 845-1637 or visit disability.tamu.edu.

Title IX and Statement on Limits to Confidentiality

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 gender-based discrimination and sexual harassment, including sexual assault, sexual exploitation, domestic violence, dating violence, and stalking.

With the exception of some medical and mental health providers, all university employees (including full and part-time faculty, staff, paid graduate assistants, student workers, etc.) are Mandatory Reporters and must report to the Title IX Office if the employee experiences, observes, or becomes aware of an incident that meets the following conditions (see [University Rule 08.01.01.M1](#)):

- The incident is reasonably believed to be discrimination or harassment.
- The incident is alleged to have been committed by or against a person who, at the time of the incident, was (1) a student enrolled at the University or (2) an employee of the University.

Mandatory Reporters must file a report regardless of how the information comes to their attention – including but not limited to face-to-face conversations, a written class assignment or paper, class discussion, email, text, or social media post. Although Mandatory Reporters must file a report, in most instances, a person who is subjected to the alleged conduct will be able to control how the report is handled, including whether or not to pursue a formal investigation. The University's goal is to make sure you are aware of the range of options available to you and to ensure access to the resources you need.

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Students wishing to discuss concerns related to mental and/or physical health in a confidential setting are encouraged to make an appointment with [University Health Services](#) or download the [TELUS Health Student Support app](#) for 24/7 access to professional counseling in multiple languages. Walk-in services for urgent, non-emergency needs are available during normal business hours at University Health Services locations; call 979.458.4584 for details.

Students can learn more about filing a report, accessing supportive resources, and navigating the Title IX investigation and resolution process on the University's [Title IX webpage](#).

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](#).

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Students needing a listening ear can contact University Health Services (979.458.4584) 24-hour emergency help is also available through the 988 Suicide & Crisis Lifeline (988) or at [988lifeline.org](#).

Campus-Specific Policies

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 may do so by going to howdy.tamu.edu and clicking on the "Directory Hold Information" link in the Student Records channel on the MyRecord tab. 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.