COMPUTER SCIENCE 373

Senior Research Seminar

CSCI 373 Handbook

Twenty-Eighth Edition

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Handbook for CSCI 373, 28th Edition

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Chapter

1

Course Overview

Course description, objectives, expectations and frequently asked questions (FAQs).

The Computer Science Department Senior Research Seminar (CSCI373) is a capstone course for Computer Science majors in their senior year. It is the alternative to an Honors Thesis and can be considered a more highly structured and regulated thesis development process, with a special emphasis on topics for students who will become professionals in the computing field.

Computer science is a rapidly changing field. Successful professionals in this field must keep up with new research and development, even after leaving an academic setting, and must be able to communicate clearly and convincingly on new topics. Overall, this course is intended to equip successful students with an appreciation for and desire to continue their education in computer science and related fields and to further improve their research and communication skills in computer science and technology.

Course Vision

The primary goals of CSCI 373 are for **you** to become **the campus expert** on your course topic *and* to build the skills to **independently** become an expert on new topics in the future.

Imagine you see an announcement of a speaker coming to campus to give a talk on your favorite computer science topic. You are interested in attending because you watched a video and read a blog by that person and know that person is an expert on the topic. You want to know the speaker's latest ideas, ask questions, and understand more about the topic. *The primary purpose of this course is to make you* ***that person*** *for your selected course topic and to* ***build skills*** *to independently become an expert on new topics in the future.*

By the end of the semester, you will acquire a collection of resources, assimilate them into a collection of rich mental models of your topic, write a significant research report,

and give a final presentation that demonstrates your expertise, taking questions from the audience and providing interesting and thought-provoking responses. By the end of the course, *you will be the campus expert on your topic.* Also, by the end of the semester, you will learn the skills to independently become an expert on new topics as needed in your future career.

Course Objectives

Upon successful completion of this course, students should have made substantial progress in the following ways:

1. **Research**: Students will have the ability to conduct research in new science and technology areas using library resources, journals, online videos, podcasts, courses and materials, generative AI tools, search engines, subscription services, and informal communications. Thorough research is important to provide context for new work and to avoid redundancy. Through research, students will be aware that new science and technology are not developed in isolation. In particular, it is important to be aware of the history that leads to new developments, to be sensitive to any ethical issues related to new developments, and to be aware of future research and development trends.

2. **Writing:** Students will improve their abilities in scientific and technical writing. The written word carries an influence that is independent of the writer. Well-written text can have an influence that exceeds the time and breadth of any other form of communication. Technical reports, position papers, emails, blog posts, and social media posts can have sustained value to retain and communicate technical information. The ability to write well is essential for long-term professional success.

3. **Live Speaking and Audience Engagement:** Students will improve their speaking skills, developing a sense of comfort and authority. They will learn to choose the scope of their presentations to hold the audience's attention best and make points clearly and efficiently. They will learn to respond to audience questions and comments with deep and meaningful replies. Good speaking and audience interaction skills complement good writing skills. Both are important to any computer professional who wants to succeed beyond the role of an individual contributor to a project.

4. **Recorded presentations:** Students will learn to develop effective recorded presentations to inform and instruct listeners and viewers. Audio and video recordings are ubiquitous and provide a preferred learning mode for many people. Audio podcasts, YouTube and TikTok videos, TED[1] talks, Khan

[1] Technology, Entertainment and Design (TED) provides a large collection of short presentations on many topics, http://www.ted.com.

Academy[2] lectures, MOOCs[3], and recorded conference presentations are just a few of the sources for knowledge delivery. Like written content, recorded presentations can have a broad and sustained impact.

5. **Discussion:** Students will improve their discussion skills by learning how to carefully listen to other participants, contribute clearly and succinctly, and elicit contributions from all members. Good discussion skills are important for clear communication in professional setting, building a respectful and comfortable work environment and developing strong professional relationships.

6. **Continuing Education:** Students will increase their appreciation for the value of continued, self-initiated education in computer science and technology and the role of technology in society. Furthermore, they will experience concrete approaches for building habits that will foster this continuing education. Computer science is a rapidly changing field, and its impact on society is always changing. Thus, professionals must develop habits to promote continued education from various information sources. Broad awareness of new science and technology, even outside a person's core field, increases opportunities to adapt to and even lead in the development of disruptions from new approaches outside that field.

Course Expectations

Students of this course are expected to do the following:

1. **Attendance:** Attend all class sessions or receive prior approval for absence from the instructor.

2. **Discussion:** Participate in class discussions. We will have a variety of in-class discussions and exercises. Exercises will include activities to develop skills in technical discussion, title and abstract writing, and technical presentation. You will develop the ability to discuss technical topics with peers at a concrete and abstract level, using basic skills of respectful discourse, including all group members, eliciting contributions from all members, and bringing decision-making discussions to group consensus.

3. **Assignments:** Complete all assignments on time, following general class guidelines and specific assignment instructions. Late assignments will only be accepted if the instructor grants prior approval.

[2] Khan Academy provides a large collection of instructional talks and other material in many academic subjects, https://www.khanacademy.org.

[3] Massive Open Online Courses (MOOCs) are an alternative and complement to in-person classroom learning. http://en.wikipedia.org/wiki/Massive_open_online_course.

4. **Self-teaching reflections:** On designated days, you are assigned to submit a reflection on articles, discussions, and presentations you have read, viewed, or heard, as described in the recurring assignments discussion in Chapter 5. You may not make up missed assignments since the whole point is to help you build a habit of self-teaching through regularly learning new ideas on your own.

5. **Resources:** Use credible sources for research content. Integrate and synthesize source material into an informed personal perspective on a topic. **Plagiarism will not be tolerated. It is grounds for dismissal from class and further discipline at the college.**

6. **Generative AI tools:** Generative AI tools are an important resource for identifying, developing, and refining content. In this course, we will use these tools as part of our content development process and explore the meaning of authorship.

7. **Holistic communication strategies:** Some people find traditional academic communication approaches such as reading and writing less effective than audio and video. In my experience, this is particularly true for people in technical fields. Fortunately, the ubiquity of audio and video media enables powerful communication techniques beyond traditional approaches. If you tend to be challenged by conventional academic communication approaches or want to explore a more holistic approach to technical communication, please contact the course instructor to discuss strategies for incorporating new approaches into your efforts for this class.

Academic and Real World

One overarching theme of this course is to help you experience "real world" situations in an academic setting. Several experiences in this course might be unusual for you:

1. **Guidance on assignments will be descriptive more than prescriptive:** *You will not typically be told the exact details of how an assignment should be completed.* As we proceed through the semester, you may have questions about assignments and what you are expected to produce. In these situations, the guidance you will receive may be vaguer than you might expect. This approach is intentional as a way to help you take more ownership for deciding how to define an assignment as well as complete it.

2. **Paper lengths:** *You will not be asked to write papers of a minimum length in this course.* You will be asked to provide sufficient content to satisfy the assignment and be given

> One day I will find the right words, and they will be simple.
> — Jack Kerouac

approximately how many words that might require. However, even that value is a suggestion. In fact, as in real life, you will be expected to use **as few words as possible** to convey your ideas.

> If you can't explain it simply, you do not understand it well enough.
> — Albert Einstein

Our class motto is: *Enough words, no more.*

3. **Topic repetition:** *By the end of the course, you will have written about and presented your topic several times.*
   You will have the opportunity and requirement to write and present your topic material several times. This is good for building expertise but also rewards good self-discipline to take advantage of the opportunities to delve deeper into your topic.

4. **Owning the topic:** *You are the owner of your topic, especially the details of what you will study and develop.*
   In most professional settings, you will have latitude and responsibility to define your work agenda. This may not be true immediately but will become a more significant part of your role as you gain experience. Having control over the details of your work can be extremely satisfying and rewarding.

5. **Intellectual challenge:** *Your topic will present you with significant intellectual challenges that you must face and own.*
   Your topic (if it is good) will present a significant challenge for you intellectually. You will have technical papers and other resources requiring substantial study, and you will only understand them after some time and effort. You will need to find additional resources (papers, faculty members, community experts) to help you understand the required concepts.

6. **Structured content:** *Large projects require several elements for delivering content. You will need to package content in several ways for various audiences.*
   Your presentations, abstracts, and conclusions play an important role in helping your potential audience understand and want to learn more about your work.

7. **Self-learning:** *You will be in charge of what you learn after graduating.*
   The computing field changes rapidly, at least on the surface. The "future you" will thank the "present you" if you build a habit of continued learning. Many resources are available for self-learning, including generative AI tools, excellent online courses, technical web portals, and thought leader blogs.

8. **Growth mindset:** *New technical tools enable new solutions.* The computing field is creating new tools that solve existing problems and enable new ways to solve other problems. And these new tools often create new problems of their own. As a computing professional, you will be creating and using new tools and designing solutions that were not possible before. Cultivating a growth mindset will enable you to see new and exciting ways to use your skills to improve society.

> The significant problems we face cannot be solved by the same level of thinking that created them.
> — Albert Einstein

Frequently Asked Questions (FAQs)

1. **How do I select a topic for my project?**
   Generative AI tools are very helpful in bootstrapping any new learning activity. Extended conversations asking questions can often be the best way to identify a suitable topic.

2. **I cannot find resources for my topic. What should I do?**
   First, read Chapter 3 to ensure you have considered all the suggested approaches. If you are still having trouble finding sources, consider broadening the topic scope, if possible. As a last resort, consider switching topic areas.

3. **I have too many resources for my topic. What should I do?**
   In this case, you should try to reduce the scope of your topic, focusing on a subset of the original scope. Many students find, as they proceed with their project, that their original topic scope is too broad. In these cases, reducing scope by focusing on a subset or subtopic of your original scope is necessary.

Chapter

2

STATE OF THE FIELD OVERVIEW

An Overview of a State of the Field Project

Overview of a State of the Field project and discussion of its components.

The overall focus of this course is a State of the Field (SOTF) project involving the full development of a topic of current interest in the scientific or technological community. The class website has some examples of past papers. Some topic areas in past years have been:

1. Algorithmic aspects of neural networks.
2. Computer vision algorithms and applications.
3. Algorithms for data-informed prediction.
4. Computer gaming algorithms.

State of the Field Components

Understanding the present state and future trends of any given topic requires understanding its related history and the societal issues that may be important to current and future developments. As a result, an SOTF project contains the following three components:

1. **Foundations:** What are the key technical components of my topic? What kind of diagrams give the big picture? What is a common step-by-step understanding of the topic? Who do I need to credit for past work I used to understand my topic? What foundational information does an 'intelligent but uninformed reader' need to know to understand my topic? We will produce the Foundations assignment in three phases, increasing depth and breadth at each phase.

2. **Explorations:** Using the Foundations as a starting point, select a subtopic you can focus on to create a demonstration of your knowledge. What kind of prototype

tool can I build to demonstrate my understanding? Alternatively, what kind of experiment can I design and execute that tests the properties of existing tools?

3. **Futures:** Based on your Explorations, what are some possible future developments in the next 6 – 12 months backed up by credible data, analysis, and expert opinion?

Details for each assignment are found in Chapter 5.

Why a State of the Field Project?

Many content creation and organization forms are appropriate for scientific and technical material. Our motivation for focusing on a State of the Field project is that it allows you to experience several styles of writing, presenting, and audience engagement while keeping focus on a single topic area. Also, the SOTF format appears in many professional settings. It is a composite format of communication that allows the writer to inform and influence the reader. For professionals in computer science and related fields, situations often arise where this type of communication is essential.

> What I cannot create, I do not understand.
> — Richard Feynman

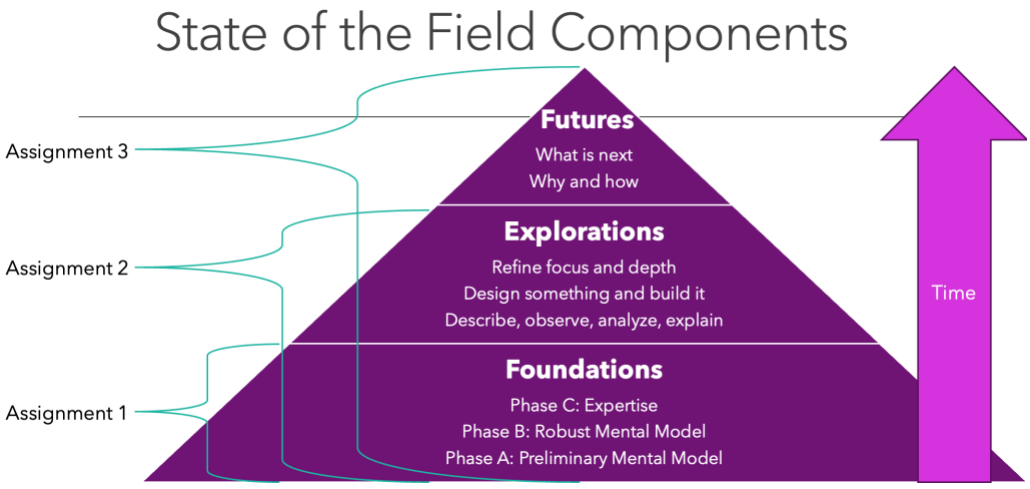

Figure 1: The State of the Field assignment is decomposed into three parts. Assignment 1 creates the Foundations. Assignment 2 creates the Explorations and refines the Foundations with new knowledge you have gained. Assignment 3 creates the Futures while refining the Explorations and Foundations to produce a complete and comprehensive final state of the field paper, presentation, and prototype demonstration.

Chapter 3

How To Succeed in this Course

General policies and advice for succeeding without unnecessary effort.

There are several issues that, if well-addressed, will help a student succeed in this course. Probably the most important is the selection of a good topic.

Select a Good Topic

We cannot overstate the importance of selecting an appropriate topic for success in this course. Two aspects are important:

1. **Topic Area:** The broad description of the topic of interest, e.g., Neural Networks. We often refer to this as your topic.

2. **Topic Scope:** The specific breadth and level of detail you will address within the topic area.

Generally we first focus on selecting the topic area and an approximate topic scope. It is generally easy to adjust the topic scope as needed during the course, but it is difficult to change topic areas. For most students, the topic scope will become narrower and deeper as we proceed through the course due to a better understanding of one element of the scope and insufficient time to explore the original scope at the needed depth.

The first phase of selecting a topic is best described as brainstorming, listing multiple topics in computer science or computer-related fields that are of potential interest to you. A good way to seed this process is to interact with generative AI tools. As

candidate topics emerge, you can confirm their relevance by reviewing general computer science journals and magazines such as Communications of the ACM, IEEE Computer, or IEEE Spectrum and watch or listen to introductory online audio and video. As you consider topics, address the following questions for each topic (**Good topic checklist)**:

1. Does it have a significant computer science component? (Does it require your computer science background to do the research?)
2. Are there sufficient high-quality, openly available resources at your disposal?
3. Is it an active field in the computer science community?
4. Can I develop a demonstration or prototype capability in this topic area?
5. Is there intellectual substance to this topic?

Often, an excellent way to limit the scope of a topic area is to look at the intersection of a technology and an application area. For example, if you start with the broad topic of artificial intelligence, you may want to narrow it to artificial intelligence as applied to recommendation systems. If your topic of interest is iris recognition, you may want to focus on iris recognition in security applications. Looking at an application area as well as a technology helps to sharpen focus on specific issues regarding the technology.

Phases of Understanding

The purpose of the Foundations assignment is to bootstrap your knowledge of your topic. This assignment will have three phases:

- **Phase A – Sketching a preliminary mental model: You don't know what you don't know.** When you begin exploring a potential topic area, you will not know enough about the topic or even understand what about the topic you do not understand. This initial phase is perhaps the most challenging because it requires you to dive into one or several potential topic areas and bootstrap your understanding without prior knowledge. ***In this phase, there is no substitute for dedicating hours-long blocks to reading, viewing, and listening to resources that can help you build an initial mental model of your topic area.***

- **Phase B – Building a robust mental model: You learn what you did not know.** After establishing a preliminary mental model, you will have names for the terms and concepts you do not understand, and you can then start learning about them.

- **Phase C – Establishing expertise: You know a lot.** In this phase you build true expertise in your topic area within the narrow scope you can explore

within the span of the course. By the end of the course, you will communicate with expertise and can answer questions with authority.

Each phase will include producing a draft of the Foundations paper. Phases B and C will build on and refine previous phases. Phases A and C also require a presentation.

Plan Ahead, Work Ahead

> If I had eight hours to chop down a tree,
> I'd spend six hours sharpening my ax.
> — Abraham Lincoln

The nature of this course and its schedule allows the motivated student to complete much of the work in the early part of the course. In particular, you should consider the following issues:

1. **Plan ahead:** Once you have selected your topic, it is in your best interest to identify and gather research material early in the course. Finding credible and relevant resources takes time, especially reviewing potential resources to determine which of them will be useful to you.

2. **Work ahead:** Your final SOTF paper and presentation synthesize your previous papers and presentations. High-quality work on early assignments not only improves your grade but also makes your final paper and presentation easier to complete.

Locate Credible and Relevant Resources

The ever-growing availability of online information has been a great asset for gathering research materials. At the same time, it is a challenge to isolate credible and relevant resources amidst all the information we can find. This is sometimes called "finding a needle in a needle stack." If you plan ahead and go beyond a first-level web search on your topic, you will find sufficient high-quality resources for your work. To improve the quality of your resources, consider the following approaches:

1. **Generative AI Tools:** AI tools provide valuable content throughout the development of your project. At the same time, these tools can be spectacularly wrong with full confidence. We will learn how to use generative AI tools as knowledge assistants in our work.

2. **YouTube:** An excellent way to build the initial mental model (Phase A of understanding, mentioned above) of your topic area is to find video content, especially on YouTube. Almost any topic area for our course will have some introductory content that provides a basic mental model for someone who is

just getting started. Other online platforms such as Udacity, Coursera, and related, may offer free or low-cost introductory material.

3. **ACM Digital Library:** We have access to the ACM digital library, which provides a wealth of journal articles and conference proceedings that will provide a foundation for your research.

4. **Web of Science**: Through the CSB/SJU Library, we also have access to Web of Science, a comprehensive citation data source for scientific content.

5. **Web searches engines:** Although web search engines are usually not sufficient for finding credible, relevant resources, they can be a good starting point. Careful selection of key words can help to identify issues related to your topic and, even more importantly, the leaders doing work in your topic area. Overall, search engines are bad way to directly find topic resources, but an excellent way to identify potential resources.

6. **Library search engines:** Our library websites contain excellent search engines that go beyond what is readily available on the Internet. These tools search a variety of collections of peer-reviewed publications that are the most reliable and high-quality source of material on your topic. These search engines are available from the main library website.

7. **Inter-library loan:** Our libraries have access to almost any printed material (via inter-library loan) in original form as a book, as a photocopy of a journal article, or in electronic form. This is an excellent resource, but it requires planning ahead.

8. **Bibliographies:** One of the best ways to obtain resources is from the citations of articles and books you have already acquired. This is probably the best way to get a complete picture of what is important in your topic area.

9. **Contact experts:** Once you have identified an expert in your topic area, an excellent way to get more information is to contact this person. Experts are accustomed to answering queries and are often excited when a new person shows interest in their subject matter. If you contact an expert, take time to understand concepts you can learn on your own and frame your questions based on what you already have learned.

How Many Resources Do I Need?

A healthy project will typically have 20 or more resources (books, articles, experts or substantial websites) that you study and understand well. **If someone pointed to one of these resources, you should be able to describe it and tell how it informs your own work.** This is what we mean by understanding it well. You will usually acquire

these resources through the first half of the course and assimilate their content during the first two-thirds of the course. These resources form the foundation for your project.

Some signs that you are acquiring sufficient resources are:

1. When you find a new resource, you see connections to others you understand.
2. You can name several community leaders in your field.
3. You observe and appreciate multiple perspectives from community leaders.
4. You see trends in your topic area that can be used to predict the future.

Own Your Work

You will be learning from many resources. At the same time, you must synthesize and express your knowledge from your understanding using your own words. An act of plagiarism has severe consequences, up to and including dismissal from class and the college. Own your work.

> I just came up with a new word. It's plagiarism.
> — Joshua Hehe

Generative AI Tools

Generative AI tools provide valuable services while exploring and creating research papers, presentations, and related content. While copy-and-paste of content from other sources has been possible for many years, the emergence of tools that produce seemingly novel output blurs the distinction between content you the author generates and what is imported from someone and somewhere else. Clear guidance and policy are still emerging, as is our internal sense of what is appropriate. Even so, there are a few guiding principles we can state:

1. Identify content that is yours as the author and content obtained from others.
2. Find and cite sources for content obtained from others.
3. Acknowledge the use of generative AI tools but refrain from citing them.

Our class policy on generative AI tools is:

1. We will embrace generative AI tools in this course.
2. We will take responsibility for the content of our papers and presentations.
3. We use generative AI tools to accelerate learning content, not replace learning.

Chapter

4

DO'S AND DON'TS

Communicating

General rules for improving your skills

This chapter lists a set of general rules-of-thumb for improving your writing, presenting, and dialogue. These are not hard and fast rules to be obeyed blindly, but are suggestions that can be useful to many people.

General

1. **Avoid grandiose language:** Avoid superlatives such as "huge", "fantastic", "are endless". These are essentially meaningless terms that belong in a marketing brochure, not a technical presentation or document.

2. **Justify strong assertions:** When you make a strong assertion such as "X is the best method for…" justify your assertion with:

    a. Objective data.

    b. Extrapolation of existing data.

    c. Quotes from recognized experts in the field.

    d. Correlation to trends in a related field.

3. **Avoid informal and imprecise language:** Phrases such as "X is flaky", "Y will take over the industry" "The future is bright" are not appropriate for professional presentations or documents.

4. **Use spelling and grammar tools:** Use the spelling and grammar checking tools in your document management software.

5. **Read for spelling and grammar errors:** Automatic tools are not perfect. You should still read the text for errors.

Writing

> Writing is nature's way of letting you know how sloppy your thinking is.
> — Richard Guindon

Writing your ideas into paragraphs, or using software tools to accomplish the same effect, is often the most important process for clarifying your thoughts. A well-written paragraph is the indivisible "atomic unit" of good writing.

Writing a complete idea in a few sentences best generates a good paragraph, worrying first about capturing the full idea you want to express. The paragraph is improved by iteration:

1. Correct grammar and spelling errors.
2. Confirm word selection in order to say precisely what you mean.
3. Reduce word count while retaining original message.
4. Repeat.

For the writer who is used to producing a paper the night before it is due, this process will be foreign, but will help produce shorter and better documents. This kind of process is the foundation for good written content.

> Enough words, no more.
> — Class Motto

For most of your academic life you have likely been told to write your papers with a minimum length measured in pages or word count. In contrast, in professional life, almost everything you write will be limited to a *maximum* page, word, or character count. In this course we will emphasize efficient and effective use of words and time.

Consider the following general rules when writing your papers.

1. **Say what you will say, say it, say what you said, but not quite:**
    a. **Intro:** Provide motivation and background for your readers, bringing them into the context you will build upon.
    b. **Body:** Present your major ideas in tightly written, compact paragraphs that flow logically from one to the next.
    c. **Conclusion:** Review your main points and synthesize points that were implicit, so that your conclusion has impact. One way to think of the conclusion is to imagine you are returning home with a friend from a movie. You describe the highlights knowing that your friend just saw the movie too.

2. **Enough words, no more:** This is our class motto for writing[4]. Each paragraph should be compact, using only a sufficient number of words. The best way to create a compact paragraph is through iteration; repeatedly review the paragraph until it cannot be improved.

> All good writing is done by compression.
> — Terry Moore

3. **Complete a draft of your paper before the due date, then iterate:** Almost certainly, an unreviewed draft of your paper can be improved. Plan for this and complete it 2 – 3 days before it is due, then iterate on it using the recommendations in this chapter.

> Rewrite. Rewrite. Rewrite. No piece of writing is ever done; it merely meets a deadline.
> — Catherine Rampell

[4] Our original class motto was, "Use enough words, no more." Iteration can be applied to mottos!

Presenting

Giving a good presentation is challenging. It is not like giving a classroom lecture; so avoid that assumption. Instead it is more like being an actor in a play.

> As an actor engages with the scene, so should you interact with your slides.

When acting, would you recite the scene description? No, these facts are obvious from the scene itself. Would you display the spoken script on the screen and then read it word for word? No, your audience would become bored. In the same way, in a presentation your spoken words and slide content should complement and enhance each other.

In a technical presentation, slides are very useful for diagrams, pictures, detailed lists of items and quotes. You may describe a slide's content, but do not repeat the words that are on it. Your audience can read much more quickly than you can recite!

Consider these additional general rules when preparing for and giving a presentation.

1. **Overall presentation impact:** Your presentation should address two fundamental questions for an audience member. **"What should I care about?"** And **"Why should I care about it?"** Make sure the overall structure and delivery of your presentation addresses these two questions.

2. **Your presentation is advertising for your paper; your paper is advertising for your work:** It is not possible or effective to cover all of the concepts and information in your paper while giving a talk. Instead, focus on giving your audience enough information in a compelling way that they will want to read your paper.

3. **Assume a comfortable, authoritative presentation position:** Look at the wall projection with us or at the audience, not the computer screen. Avoid a rigid stance behind the podium.

4. **Avoid "My topic is…":** Avoid "My topic is…" as the introduction to your presentation.

5. **Avoid "They say…":** Avoid "They say…". Who is "they"?

6. **Be prepared to answer questions:** If you mention a term or concept in your presentation, or make an assertion, be prepared to answer questions about it. If you are not familiar with the idea, leave it out of your presentation.

7. **Do not use slides as note cards:** Use figures, pictures, icons and (modest amounts of) motion in your slides. Avoid large amounts of text on slides. With the exception of quotes, do not read from your slides.

8. **Perform sanity test:** Before you give your presentation, walk through the setup process.

9. **Deliver key points in conclusion:** A typical audience member will remember only a handful of key points from a presentation. Because of this, you should design your presentation as follows:

    a. Develop a draft of your presentation.

    b. After reviewing the draft, decide what handful of points you want your audience to remember. These points will be your conclusions.

    c. Remove content from your presentation that is not essential to making your key points.

    d. Add content that will support your key points.

    e. Foreshadow your key points, individually or as a thesis, in the introduction of your presentation.

Dialogue

The deepest form of communication is dialogue. Within a community, knowledge is created when people engage in dialogue and build a better understanding than would be possible for any individual.

> Dialogue is essential: Knowledge is created on the edges.

Because generative AI tools can create content of similar style, depth, and quality as a person, a large portion of your course grade will be determined by how you demonstrate your knowledge in interactive dialogue throughout the course.

Your level of expertise, as determined from periodic dialogue during the semester, will be the primary focus of this course. Since generative AI tools can produce near-perfect prose, high-quality writing is expected from everyone but will not be the primary basis for determining success in the course.

Chapter 5

Course Assignments

Detailed descriptions of course assignments for the entire course

This chapter describes all major course assignments in detail. In addition to the assignments described here, we will have smaller exercises as part of class discussions.

Recurrent Assignment: Self-teaching reflections

Due: Every Friday by noon, except for official semester breaks (Thanksgiving, Spring Break, Easter, and similar).

Description: One of this course's primary objectives is to foster continuing education habits. In support of this objective, each student will complete regular learning assignments.

Requirements:

1. Read one article and watch or listen to one audio/video resources.
2. At least one source must be peer-reviewed. Any journal published by the Association for Computing Machinery (ACM) would be appropriate.
3. The other source can be from any resource, including business and technology newspapers, as long as the article has some connection to computing. TED talks, YouTube videos, Khan Academy, or similar resources are acceptable.
4. Before each class meeting, you will submit (using an online form available from the class website) reflections on the content from their sources. The reflections should include any reaction you had to its contents. **Note: You may use generative AI tools to create a summary of the resource. If you do so, you should describe how the generated summary matches your understanding of the content.**
5. NOTE: Sources must be selected from outside your SOTF topic area after the first two assignments.
6. As class schedules permit, we will discuss some of the submitted reviews. Come prepared!
7. **NOTE: Consistent submission of these assignments is required for passing this course.**

Recurrent Assignment: Class Discussion

Due: During in-class discussion and exercises.

Description: Discussing scientific and technical information requires the ability to communicate using precise language, good listening skills, persistence in clarifying technical ideas, respect for discussion participants, and inclusion of all participants. If decisions are to be made as part of the discussion, a good discussion leader will work to reach a consensus and identify points of contention. All discussion members will respect others' time by speaking clearly and succinctly.

Requirements:

1. Complete any pre-class preparations.

2. Participate in discussions as part of in-class exercises.

3. Exercises will include practice of basic scientific and technical discussion skills, and group exercises on title and abstract writing and presentation development.

4. We will also regularly discuss current topics in computer science using articles or books that were assigned for reading between classes.

5. Class members are expected to come prepared for discussion, participate by speaking, listening, drawing others into the conversation, and treating others with respect. Furthermore, when appropriate, group members should work toward a consensus when making decisions.

Recurrent Assignments: Technical Writing

Due: As directed on the class website.

Description: We will learn about and practice writing content in the form of abstracts, position papers, essays, and via generative AI tools. These assignments will be scheduled throughout the semester.

Assignment 1: Foundations

Description: A foundation project focuses on finding previous work on a research topic. In this assignment, you will find and assimilate a collection of articles, videos, and audio recordings that help you to form the mental model of your topic area.

To prepare for your foundations assignment, you will collect articles, generated content, videos, and audio recordings that help you understand the principles of your research topic.

If you have a topic area whose foundation is related to other students, you are encouraged to share resources you find with those other students. Your instructor will help you identify possible resource-sharing opportunities.

Requirements:

1. Each student will write a Foundations paper in three iterations corresponding to the phases described in Chapter 3:

    a) **Phase A: Preliminary mental model.** You will identify key concepts in your topic area as the things you need to know but are still not well understood by you. This phase will also require a short "pitch talk."

        i. **Video presentation:** Each student will record a 30 – 45 second video that gives the viewer an essential idea of your topic. We will show all videos in class.

        ii. **Dialogue:** After showing your video, we will ask questions to assess your progress in building your knowledge of the topic.

    b) **Phase B: Robust mental model.** In this iteration, you will describe the key concepts. You will describe important entities in your topic and their relationships to each other.

        i. **Paper:** This assignment has a paper only, no presentation.

        ii. **Presentation:** None.

    c) **Phase C: Expertise.** You will demonstrate a deep understanding of a particular aspect of your topic, typically a narrower scope than what you were initially exploring. This phase will also require a formal presentation.

        i. **Live presentation:** The presentation will be 10 minutes.

ii. **Dialogue:** After your presentation, we will ask questions to assess your progress in building your knowledge of the topic.

2. The Foundations assignment has two purposes: **inform your reader about basic concepts and cite the resources you have used to learn what you know.**

   a. **Inform the reader:** Your paper will describe the foundational ideas for your topic area. For example, suppose your topic is machine learning for image recognition. In that case, you will describe machine learning concepts and then talk about standard machine learning algorithms used for image recognition. Each iteration will build depth and reduce scope.

   b. **Cite resources:** Finding credible resources will occur throughout the semester. Each iteration of this assignment will have additional resources you have found, understood, and used as part of your writing and presentation. Some minimum resource targets are:

      i. **Phase A:** 5 resources that cover the "big picture."

      ii. **Phase B:** 10 additional resources, including detailed peer-review papers that require substantial study.

      iii. **Phase C:** 5 or more additional resources that provide additional perspectives on your topics. At this point, you should understand enough about your key resources to quickly summarize what you learned from each of them.

   c. There is no minimum or maximum length for papers in this assignment. They should be long enough to accomplish the two purposes listed above for the assignment phase.

Assignment 2: Explorations

Description: You will create a prototype tool or design and execute an experiment demonstrating your understanding of your topic.

Requirements:

1. **Paper:** Add a description of your prototype or experiment to your Foundations Phase C paper. This content will be submitted along with your Futures content in the final State of the Field paper.

2. **Demonstration:** Based on your understanding of your topic:

    a. **Create a prototype tool:** You will develop a prototype software tool that demonstrates your knowledge. The availability of generative AI tools makes creating a prototype tool easier than ever. Use AI tools to help you build your prototype. **Or**

    b. **Conduct a "science fair" experiment:** Alternatively, you may design an experiment that uses existing tools to demonstrate your understanding of their behavior. For example, you could select several online tools to predict future events. Based on your knowledge of how these tools make predictions, you could form a hypothesis of how the tools will behave, design and execute an experiment to test the predictive abilities of these tools and report on whether your hypothesis was correct.

3. **Video presentation:** The recorded presentation will be 3 minutes.

2. **Dialogue:** After showing your video, we will ask questions.

Assignment 3: Futures

Description: You will write a section on future trends for your final State of the Field paper and presentation.

Requirements:

1. Based on your informed opinion, predict what the State of the Field will be like for your topic area in the next six months to a year.

2. Provide evidence to support your claims; avoid exaggerated claims and substantiate your predictions with:

    a. Observed Data. – Similar setting.

    b. Observed Trends.– Observed data over time.

    c. Known constraints. – Global min/max.

    d. Mathematical models.

    e. Expert opinion.

3. Build your predictions using the mental models you developed for your Foundations assignment.

4. **This content will be a section of your final State of the Field paper and provide content for your final presentation. It will not be a stand-alone assignment.**

Assignment 4: State of the Field

Description: You will write a paper, give a presentation, and lead a discussion on the State of the Field for your topic. This assignment is a synthesis and comprehensive revision of previous papers and presentations.

Requirements:

1. You will give a detailed assessment of the State of the Field for your topic, including all appropriate material you have previously developed throughout this course.

2. **Paper:** You will write your paper using LaTeX and the IEEETran document class. It will include the final version of your Foundations content, a description of your Explorations demonstration, and future trends.

    a. You will include a 3 – 5 paragraph appendix section (using \appendix LaTeX command) that explicitly identifies the previous course work and experience you used to complete the current course project. You will also identify how the current project has deepened and integrated previous coursework and experience.

    b. Include charts and diagrams to illustrate trends. Most or all figures should be your original work. Include table of contents, lists of figures/tables, section headings, and other navigational aids.

    c. There is no minimum or maximum length required for the paper.

    d. You will include a statement when you submit your paper via email describing how you have addressed all writing rules listed at the end of this handbook.

    e. **Note:** The paper you write for this assignment will be much longer than those for the previous assignments. As are result, structuring your document becomes much more important. In particular, the following elements will be necessary:

        i. An abstract following the Koopman structure and a substantial introduction previewing the thesis and content of your document.

        ii. Table of Contents, Lists of Figures, Tables, generated by LaTeX.

3. **Live Presentation:** You will give a 12-minute presentation. Your presentation should cover a subset of your topic content and conclude with a handful of key points.

4. **Dialogue:** After your presentation, we will ask questions to assess your knowledge of the topic.

CS373 Writing Evaluation Form

Your assignment is graded on a five-point scale for each of the following ten writing rules. An additional 50 points is graded for overall paper quality.

Rule #1: Assume your reader is *intelligent* but *ignorant*. _____
- Did you write an introduction?
- Did you write a paper that is accessible to non-experts?

Rule #2: _____
1. Tell them what you will say.
2. Say it.
3. Tell them what you said and more.
   Use the conclusion to make your final clear points, synthesizing content.

Rule #3: Define all terms and acronyms. _____
- Use the format this is a Brand New Acronym (BNM).
- Describe new terms when you first use them.

Rule #4: When possible, use plain language and avoid jargon. _____
- Avoid informal language, contractions, slang, and imprecise terms.
- Use concise sentences.
- Remember our motto: **Enough words, no more.**

Rule #5: Make consistent use of terms and notation. _____
- Read through your document to ensure you define and consistently use terms.

Rule #6: Search the literature and cite other works. _____
- You should have at least the minimum number of high-quality, well-understood references.

Rule #7[5]: Use pictures, charts, and graphs, but keep in mind #4. _____
- Include one or more mental model diagrams with substantial captions.
- Pictures are worth a thousand words or more. Use them.
- Provide a 2-3 sentence descriptive caption that explains the figure or table.

Rule #8[7]: Use examples to explain complex ideas. _____
- Any complex topic can benefit from providing a concrete example.
- But make sure the example is genuinely relevant.

Rule #9[7]: Use: _____
- Headings (Section, etc.).
- Bulleted Lists, numbered lists.

to provide structure, clarity, and conciseness to your document.
- LaTeX provides excellent support for these document elements.

Rule #10[6]: Provide guidance: _____
- Abstract.
- List of Figures, List of Tables.
- LaTeX provides these elements as well!

[5] Rules 7, 8, and 9 are required for Phase C of the Foundations paper and Final SOTF paper.

[6] Rule 10 is required for the Final SOTF paper only.

CS373 Presentation Evaluation Form

Your presentation is graded on a five-point scale for each of the following ten writing rules. An additional 50 points is graded for overall presentation quality.

Rule #1: Tell us a story. _____
- Do you have a beginning, middle, and end?
- Did you explain *what* the audience should care about and *why* they should care?

Rule #2: Pick a realistic scope. _____
- Pick the most important topic elements for the amount of time you have.
- Stick to a core message, knowing that your paper has more detail.

Rule #3: Keep your presentation focused. _____
- Identify your key points (see Rule #10).
- Your entire presentation should help the audience understand and respect your key points.
- Remove anything from your talk that is not connected to your key points.

Rule #4: Make slide content complement what you say. _____
- Put technical details, dates, names, and facts on your slides and trust the audience to read them.
- Include a slide with a "big picture" diagram that illustrates the mental model for your topic.
- When making a point, the slide title should state the point**.**
- Avoid slides that are just an outline of what you will say.

Rule #5: Prepare for disaster. _____
- A copy of your presentation slides is available online or on another device.
- Be prepared to speak even if slides are not available.

Rule #6: Be prepared to explain and defend your comments. _____
- Anticipate questions your audience might ask and have backup slides ready if needed.
- Avoid saying things you are not comfortable defending.
- If you don't know how to answer a question, say, "I don't know."

Rule #7: Respect your time limit. _____
- Practice your presentation and track how long it takes.
- Be prepared to skip some content to stay on time.
- Be aware of the remaining speaking time.
- *Never* speak longer than your allotted time.

Rule #8: Dress up. _____
- Wear clothes from the more formal end of the spectrum of your wardrobe.

Rule #9[7]: Remind us of where we are in your story: _____
- For longer presentations, periodically remind us of where we are in the story.
- Use an outline slide highlighting the upcoming story element, or something similar.

Rule #10[8]: **Make your final key points:** _____
- **Make your ending memorable. Focus on 3 – 5 takeaways you want remembered.**
- **Make the points clear and concise, wrapping up the story you told.**
- **Ensure the key points address what we should care about and why.**

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[7] Rule 9 is required for your final SOTF presentation.

[8] **Rule 10 is key. *Every* talk should end with its key points.**