EECS 545 Winter 2026 Course Project Information

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Link to this doc: [public]

The term project gives you, as a small group, a chance to explore novel extensions or applications of machine learning to problems that interest you in the form of a mini-research project.

Project Topics

The first deliverable you will need to submit is the project proposal. To do so, choose a good project topic first. Some general words of advice: choose a topic that genuinely interests or excites you, work with others who are also interested in the topic, and be both ambitious and reasonable in the scope of the project.

Historically, many students are having difficulty in choosing the project topics, so we decided to pre-provide the list of topics this year. You can find the list of topics from Canvas: https://umich.instructure.com/courses/813804/pages/project-suggestions-by-staff.

You don't have to select the topic from the suggested list above but please note that it could be harder to provide in-depth or detailed comments for those projects the staff members are not familiar with. So please choose this option at your own risk (e.g., not getting sufficient or meaningful feedback, difficulty of evaluation, etc.).

If you want to choose the topic of your own, please be aware that **you must get approval from the instructors**. The final approval will be provided as the response to your project proposal document. However, if you want to check it sooner, please reach out to our course staff via email (eecs545.staff@gmail.com) (**please DO NOT send an individual email regarding your custom project proposal**). The type and nature of potential projects can vary as follows (we crossed out theoretical projects as students rarely work on them):

> **Application project**. This would be by far the most common category of the project: Pick an application that interests you, and explore how to best apply machine learning algorithms to solve it. The goal is to try to apply machine learning methods and techniques we learn in the class to some novel (i.e., unpublished) and non-proprietary datasets or to any application domain. Please articulate the objective or goal you'd like to achieve and what ML methods can be applied. Ideally, the experiment/analysis should include a comparison of many different ML approaches and analyses and show your efforts to improve the performance (e.g., feature engineering, cross-validation, parameter tuning, etc.). Kaggle challenges would be a great example of this category.
> **Algorithmic project**. Pick a problem or family of problems, and develop a new machine learning algorithm or a novel variant of or improvement to an existing algorithm to solve the problem (e.g., improvements can be in different forms: model/network architecture, loss function, regularization, computational efficiency, etc.). For example, a combination of existing algorithms to come up with a non-trivial, better method will also be a good project idea. This will be more like open-ended research; you should try to add novel contributions in terms of methodology, algorithm, analysis, etc, and deliver some new findings if applicable. The novelty will mostly lie in the algorithmic and practical aspects, so it is okay to work on an established benchmark or dataset.

Some projects will also combine elements of applications and algorithms, and theory. Many fantastic class projects come from students picking either an application that they're interested in or picking some sub-field of machine learning that they want to explore more and working on that as their project. If you currently work in an industry and have an application on which machine learning might help, that also could potentially make a great project.

Possible Datasets (if you want to suggest your own project):

If you want suggestions on some datasets for your project, the links below can be useful (but some of them are being outdated as the field of ML progresses very quickly). If you have questions about choosing your dataset, please contact the GSI or instructor for advice.

Kaggle competitions: http://www.kaggle.com/
EvalAI Challenges: https://eval.ai/web/challenges/list
Datasets that can be used for Deep Learning models (or non-deep-learning models): http://deeplearning.net/datasets/ https://paperswithcode.com/datasets
Fake detection datasets: Deepfake Detection Challenge Dataset
NLP Datasets (some of these are getting saturated/outdated): GLUE, SQuAD, CoQA, SuperGLUE, MMLU, BigBench, Open LLM Leaderboard, etc.
(Deep) RL environments of toy games: OpenAI Gym, DM Control Suite, DeepMind Lab, MuJoCo, FurnitureBench
Network and graph datasets: http://snap.stanford.edu/data/

Examples of projects from other ML courses:

We list some collections of publicly available ML course projects.
2021 Spring: https://cs229.stanford.edu/proj2021spr/
2020 Spring: https://cs229.stanford.edu/proj2020spr/
2019 Fall: https://cs229.stanford.edu/proj2019aut/
https://cs230.stanford.edu/past-projects

To provide more information about projects, we provided our own example reviews and comments for selected projects from CS 229 (these are publicly available projects):
https://docs.google.com/spreadsheets/d/e/2PACX-1vTrC_eQL33dQ7XayIRIwh_KNpmeCBpYIBHr6vJ--yGA0ImHMohiOjPdM2ozHVEGQfJUTowXg2vPG_u3/pubhtml?gid=0&single=true

In the spreadsheet, we used a 4-point scale for each criteria (roughly speaking, they correspond to "excellent", "good", "fair", "poor"). Please note that there might be some small "noise" in the numerical scores, although we try to calibrate the scores for each criteria as much as we can.
The goal of the examples is to provide guidance and direction for what we are looking for in the class project, not for information about how we will grade future projects exactly.
Please note that some projects were performed in 2015, and they may not feel novel or impressive anymore by today's standards. Even projects done a few years ago may not be relevant anymore. However, they received very high ratings at that time (e.g., selected as one of the best projects in CS 229) as they investigated "hot" topics/techniques in ML around that time. A similar rationale on both ends can be applicable to 545 projects this semester.

Additional Project Resources:

Papers from the machine learning or related conferences could be relevant: e.g., ICML, NeurIPS, ICLR, CVPR, ICCV, ECCV, ACL, EMNLP, NAACL, AAAI, IJCAI, etc.

Project Evaluation Criteria:

Significance (25%): [Note: Significance is about Impact and Relevance, **Results and Outcomes**, and broader Applicability/Generalizability.]

Is the problem important or interesting? Did the authors clearly motivate the importance of this research or why this project can be interesting?
Do their evaluations reasonably measure this usefulness (e.g., evaluating on real problems might be more motivating than on small toy problems, identifying strengths and weaknesses, spaces of problems where their approach will excel and spaces of problems where their approach may not excel)?
Are the results potentially impactful or generalizable?
Does your evaluation convincingly demonstrate how well your approach addresses the problem?

Technical Quality (25%):

Is the problem statement well-defined?
Is the chosen method sound, with appropriate mathematical or algorithmic foundations?
Have you implemented the methods carefully and tested them thoroughly?

Note: Your project will be evaluated highly if you propose a well-suited model and provide a mathematically sound algorithm to solve the formulation.

Novelty (25%):

What is new here? A new algorithm, a new application domain, a non-trivial extension of prior methods?
If you are applying standard methods, do you push them in a new way or domain?

Note: Please try to be as creative as possible and articulate what aspects of your project are different from previous works.

Presentation (25%):

Is your writing clear and understandable?
Does the paper have proper formatting, structure and organization?
Do you use figures, tables, and explanations effectively?
Is your report well-organized, with a logical flow from problem statement to results?

Note: Ideally, the reports should be mostly understandable to your fellow students (who are taking 545). Please try to add figures or diagrams that explain your problem and approach, which will be very helpful in explaining your approach. Please be clear in Figures and Tables and provide sufficient explanations; please avoid using unnecessary jargon, and your terminology and notations should be clearly defined (i.e., self-contained).

Some additional remarks about our expectations:

A solid baseline plus a clear innovation is the ideal approach. Show us how your changes or contributions make a difference, whether in performance or some other meaningful metric.
Measuring impact of ideas: It's important to demonstrate how the new ideas or approaches make a difference when applied to the baseline. This involves showing any improvements or changes in performance, as well as providing interesting analysis and proper interpretation of your results.
We do not expect top-tier conference-level breakthroughs. You do *not* need to achieve state-of-the-art results on major ML benchmarks.
Effort matters. Projects with trivial datasets or pre-packaged code that is not extended or analyzed in a new way typically receive lower significance scores.

Seeking interesting and meaningful outcomes: The expectation is to do something interesting and try to produce meaningful results, rather than just imitating existing models. In addition, please think about what is the "delta" between your idea and baseline.
Grading based on the nature of projects: Though we will evaluate based on those criteria, please note that our expectation for each project may vary. For instance, we may focus more on performance/technical quality for challenge-driven (e.g., Kaggle) projects and novelty for research-driven projects.

Project Deliverables:

Project proposal

Due: 02/03/2026, Tuesday (23:55 PM)
Note: Using up to three free late days for this project proposal, you can submit the proposal by at most 02/07 (23:55 PM). After this, late days will be deducted (1 point per each additional late day deducted out of 25 points allocated for the project) for each team member (please see the announcement for details).

The main purpose is to get you started. The proposal won't be graded, but you will get penalized if you don't submit the proposal on time. Also, it is completely fine if you change the project topic after you submit your proposal, but try to write a good one so that you can receive helpful feedback and comments from instructors.

What you will need to submit is a maximum 3-page document clearly specifying your proposed project, including the statement of the problem, your proposed approach, and evaluation methodology. Also, include a brief review of related work, and please try to articulate what aspects of your project are different from previous work (i.e., why your project is not completely subsumed by prior work) and the existing approaches on which your project is built. Further, you should try to formulate the problem as precisely and clearly as possible in both mathematical and algorithmic details.

To reiterate, please address the following questions as much as possible:

[Problem statement] What is the problem that you are trying to solve?
[Significance] Why is the problem important and interesting? What are things that are held back because your problem has not been solved yet? What are great things that could happen if you solved your problem?
[Related work] What is other people's work that is related? Why is your method/approach different from other work?
[Proposed method/approach] How are you going to solve the problem? What's your key idea/insight about your method/approach? It doesn't need to be very fleshed out at this point, but try to convey the high-level idea.
[Evaluation] How are you going to evaluate your method/approach? What is the evaluation metric or protocol? Which dataset or benchmark are you going to use?

NOTE: clarity is key. Please try to write clearly in terms of the problem, significance, related work, proposed ideas, and evaluation.

NOTE: Policy on the size of project teams:
Due to the large volume of enrollment, **each project team should be 4 or 5 people**. **A project team with 1-3 people is NOT ALLOWED.**

Please keep in mind that we will not consider the number of people on a team when we grade your projects. Empirically, the quality of projects has been strongly correlated with the number of people in a team. So, by

forming a team with a small number of people, you are taking a higher risk on your own.

NOTE: If you submit the project proposal late, this will incur late days. If you exceed three late days for the proposal, your project score will be deducted by 1 point for every additional late day.

Hope this policy is clear enough, and we wish you good luck in finding the right project topic. We encourage students to attend office hours and actively discuss with the instructor & GSIs.

Progress Report (5 points)

Due: 03/13/2026, Friday (23:55 PM)

This will be a 6-page document updating your project proposal by outlining your progress to date, clarifying your problem statement and approach, progress you have made, and specifying your plans going forward.

The writeup document should be **up to 6 pages, excluding references, author contributions, and appendices,** updating your project proposal by outlining your progress to date, clarifying your problem statement and approach, progress you have made, and specifying your plans going forward.

Formatting:

You will need to submit a letter-sized single PDF file typeset with LaTeX.

Please feel free to use any good public LaTeX template, e.g., https://github.com/dustinvtran/latex-templates.

We also provide a simple, minimal template for the project report below.

```
\documentclass[11pt,letterpaper]{article}
\usepackage[latin1]{inputenc}
\usepackage{fullpage}
\begin{document}

\title{Title of the project}
\author{Author names (and their umich.edu emails)}
\date{}

\maketitle

\begin{abstract}
Please write an abstract (executive summary) here in a paragraph.

\end{abstract}

\section{Introduction}
Introduction starts here...

\end{document}
```

In your project progress report, please include the following:

- Project Title
  - Please put a specific and informative title (that describes what your project is about)
  - For example, “545 Project Progress Report” is NOT a specific and informative title
- Team members (* Please put these at the beginning of your report)

Please specify the full name and email addresses in uniquename@umich.edu
You can specify the names and emails as the following format
author1, author2, author3, …, authorN
{email1, email2, …, emailN}@umich.edu
Abstract (1 paragraph)
Section 1. Introduction:
Problem description and motivation.
Why do you want to solve this problem?
What's the impact if you can solve this problem?
Section 2. Proposed method:
How are you going to solve this problem?
Why should the proposed method work?
Provide explanations/rationale of why you chose this specific method
Provide technical details of your approach if you are proposing a novel method.
Description of the pipeline. Including a figure (e.g., block diagram) that explains the pipeline will be very helpful
Section 3. Related work:
What are existing methods?
What are the state-of-the-art methods for this problem?
How is your approach similar to other existing work?
How is your approach different from the related work?
Section 4. (Preliminary) Experimental results:
Milestones achieved so far (add all relevant experimental results).
How do these results support your claim?
Section 5. Future milestones: Dates and sub-goals (please set sub-goals on a weekly basis so that they can be done in a week)
Section 6. Conclusion: Summary of your progress and your final expected goal (what do you expect to achieve or demonstrate for the final project?)
Author Contributions
Please see the guideline “Contribution of each team member” below
References

Policy about late days:

Maximum three late days will be allowed. Late-day tokens will be deducted from each of the team members, so please count well how many late days will be available for individual team members. After this, any 24-hour increment will count towards one additional late day.
Your report will not be accepted after three late days

Additional tips: Recommended content in the report

Dataset and/or data collection
Pre-processing
Feature representation
Pipeline of the method
Initial results
Tables
Plots
Figures (e.g., qualitative examples)
Visualization of results/models
Hyperparameters and how they were tuned
make it clear how you performed cross-validation (hold-out CV, or K-fold CV, etc.)
For hold-out CV, specify whether you separated training, validation, and test set
For K-fold CV, specify K value.
Error and failure case analysis
Summary and future work

Code

We will ask for code submission for the final version but not for the progress report.

Math/derivation

If you are using a familiar method covered in the class (e.g., linear regression, logistic regression, SVM, etc.), you don't need to provide details of the math.
If you are using more advanced/sophisticated methods, then we recommend you to explain the rationale of the method (why the method is reasonable for tackling the problem, intuition behind the method, etc.) and provide some reasonable details of the math.

Contribution of each team member

In the mid-progress & final report, please provide a very explicit statement on what each person worked on and how much each person contributed to the project. Also, please specify whether all co-authors equally contributed to the project, or if not, specify why not.
For example, the description would look like: "A and B collected data and worked on pre-processing. C and D developed a classification pipeline and performed a hyperparameter search. E helped with data collection, experiments, and error diagnostics. All co-authors were involved in writing this report. All co-authors equally contributed to this project."
We will also ask students to invite EECS 545 GSIs (we will share the details, including the account name, in a later announcement) to the working Github repository (not the one for public release).
Shortly after the final report submission, we will have a private, confidential survey about other team members' contributions.
For more detailed guidelines, please see the following links:

Guide from Nature (http://www.nature.com/nature/authors/gta/):

> "Author Contributions: authors are required to include a statement to specify the contributions of each co-author. The statement can be up to several sentences long, describing the tasks of individual authors referred to by their initials. See the authorship policy page for further explanation and examples."

Example statements (available from http://www.nature.com/nature/journal/v399/n6735/full/399393b0.html)

> "R.R. conceived the experiment, and together with A.H. and L.L. carried it out; C.D.B. designed and carried out the data analysis; R.R. and C.D.B. co-wrote the paper."

More examples (available from http://blogs.nature.com/nautilus/2007/11/post_12.html)

> "J.L., J.R.S. and J.W.L. conceived the Brainbow strategies. J.R.S. and J.W.L. supervised the project. J.L. built initial constructs and validated them in vitro and in vivo. T.A.W. performed all cerebellar axonal tracing and colour profile analysis with programs developed with J. Lu. H.K. performed all live imaging experiments. R.W.D. generated Brainbow-1.0 lines expressing cytoplasmic XFPs, and R.A.B. generated Brainbow-1.1 constructs and lines. J.L., T.A.W. and R.W.D. screened mouse lines."
>
> "S.H.C. designed and performed experiments, analyzed data, and wrote the paper; N.C., M.T,. and J.M.G. designed and performed experiments; D.R. and M.B.G. developed analytical tools; and C.I.B. designed experiments, analyzed data and wrote the paper."
>
> "All authors contributed equally to this work. A.C. and J.H.H. conducted the observations at the telescope. A.C. reduced the data, and P.W.L. performed the Monte Carlo modeling. A.C. wrote the main paper, and P.W.L. wrote the Supplementary Information. All authors discussed the results and implications and commented on the manuscript at all stages."

Together with the text description above, please provide a table format specifying contribution in a visual way. Please use the following format: row: type of contribution (short description of a task performed), column: name of project member, for i,j-th row/column of this table, mark each entry with a symbol ✓ (latex symbol: \checkmark via \use{amsmath} package) if the member (column j) made a certain contribution (row i).

Poster Presentation (5 points)

Due: 4/24/2026 Friday (Tentative time TBD: morning)

The poster session will be your chance to share what you learned with the rest of the class.

Final Report (15 points)

Due: 4/30/2026 (23:55 PM)

This will be a maximum 8-page final report (excluding references and appendix) for your project. You should write the final report in “technical report” style, clearly stating the problem, relevant background, your approach, and your evaluation of your approach. Refer to the (suggested) structure and sections above.

FAQ

Q: Notes on novelty:

A: In past offerings, many of the 545 projects were applying some standard ML methods to (new) problems. In such cases, the technical novelty might be considered moderate, but those projects were still well received with good ratings if other dimensions were strong (such as novel/creative applications, strong empirical results, etc.). We want to clarify that it’s perfectly fine if your project is application-oriented. In such cases, if your project is novel in other aspects (e.g., novel applications, novel problems, etc.), please clarify this. In addition, we recommend you put efforts into achieving strong/impressive empirical results (see more comments on significance below and the grading criteria for details).

Q: Do we have to produce cutting-edge, publishable research? Is that expected?

A: No. We do not hold you to top-tier conference standards. We do, however, expect a meaningful effort, a clear approach, and insights that go beyond just running a script.

Q: Notes on significance:

A: Generally speaking, the projects with strong empirical performance/demonstrations on a nontrivial/challenging problem will receive high ratings in terms of significance. In addition to the empirical results, significance will also reflect our perception on how much effort was put into the project. (For example, running an off-the-shelf open-source demo code on small-scale toy data, such as MNIST, can be done in less than a day and won’t be considered significant. On the other hand, the more you can convince ML experts that your problem is not something trivially doable within a short amount of time, the higher significance rating will be.) Therefore, please clarify in what aspects your project was difficult/nontrivial (e.g., the complexity of the problem, technical difficulty, implementation, data collection, etc.), and this will be helpful in highlighting the significance of your work.

Q: Can we use existing open-source code for the project?

A: Absolutely! Using libraries (SciKit-Learn, PyTorch, TensorFlow, etc.) and starting from open-source projects can be a good starting point. The key is to demonstrate what new or additional steps you take (e.g., new data, new features, custom modifications, deeper analysis). Simply cloning code and re-running it on the same dataset with no alterations or analysis is not sufficient.

Q: Do we have the flexibility to completely change our project as the semester goes on and we learn more ML methods and applications?

A: It's allowed but not recommended. We assume that you put sufficient effort/thoughts into coming up with a good proposal from the beginning. You could change the topic later, but it will mean that you will lose momentum and have less time to work on that new topic. The semester (and the actual time you can work on the project) is not that long (just a few months long at most), so coming up with a good topic will serve well. (But as I stated above, we won't explicitly penalize your project just because you changed the topic.)

Q: Can I work on the course project individually?

A: Unfortunately, no. Due to limited teaching staff and the size of the class, we require that each team have 4~5 students. Also, the quality of the project is generally correlated to the team size.

Q: Does everyone in the group need to turn it in, or is only one submission per group necessary?

A: Please submit only one proposal per group on Canvas.

Q: Do we have any free computing sources available?

A:
In every semester, we seek support from ARC about free GreatLakes credit. We will make an announcement about this if free credits are approved.
Additionally, you can consider external services such as Google Cloud, AWS, Google Colab, etc. Some of them provide free credits for initial sign-ups/trials.

Several platforms offer free cloud-based GPU resources with varying features and usage limits. Please note that specific gpus and free resource policy are subject to change, so please check their websites.

- Kaggle Notebooks provides access to NVIDIA Tesla P100 GPUs with up to 30 hours of usage per week.
- Google Colab offers NVIDIA K80, T4, P4, and P100 GPUs, allowing sessions up to 12 hours.
- Paperspace Gradient supplies NVIDIA Quadro M4000 GPUs with sessions up to 6 hours.
- Amazon SageMaker Studio Lab offers NVIDIA T4 Tensor Core GPUs with up to 4-hour sessions and a daily limit of 8 hours.
- Codesphere provides shared GPUs with sessions entering standby after approximately 60 minutes of inactivity.

Each platform may cater to different project needs and user preferences.

Q: Will each member in the group be deducted the same late day when the group uses it?

A: Late days for projects will be allowed up to 3 maximum late days for the proposal or the project progress report (we won't accept progress reports if they are late by more than three days). However, no late days will be allowed for the final project report submission. In general, we recommend not using the late days for the project progress report, but if you use them, then we will deduct the same number of late days from each team member (in other words, basically, you will have fewer free late days available if you use late days for the project progress report).

Q: Are references included in the page limit of the progress report/final report?

A: You can put references outside the page limit. However, your main text, not including the references, should be within a limited number of pages.

Q: In the progress report/final report, are we allowed to adjust the order of the sections? For instance, can we swap the order of "Proposed Method" and "Related Work."?

A: In general, we recommend following the suggested ordering, but if you have a strong reason to adjust the order, you can do that as long as it serves the purpose of presenting your project clearly. The abstract and introduction sections must be the first section in the report.

Q: Due to the page limit, are we allowed to include the implementation details and pseudocode in an appendix?

A: Yes, you can have an appendix. Also, the bibliography and contribution section do not count toward the page limitation.

Q: Are we allowed to use python packages like SciKit-Learn, TensorFlow, PyTorch, etc. for our project?

A: Yes, for the project, you are allowed to use any package in your implementation (unless the library "trivializes" your work and effort for the project).

Q: Since we have more than one GSI grading our projects, is there any chance that one GSI is more strict than others?

A: Yes. We always adjust and calibrate the score so that the mean and variance of the score over different GSI are the same.

Q: Is the final project purely a paper? Or is there some sort of virtual poster presentation?

A: As we planned, we will be holding a poster presentation as well as the final report.

Required:

(1) Live presentation; at least one student in your team is required to present your work in the poster session.
(2) Please submit your slide files (pptx or pdf)

Optional: Video presentation (mp4)

Please see the announcements we will send out later for the details.

Q: The structure of the final project report is really similar to the progress report, especially the introduction part. How much do we need to change in the introduction part?

A: There is no mandatory rule on the change in the intro section, especially if the high-level story and contributions are similar to those of the progress report. If you have an updated/different conclusion, then it would be reasonable to make changes accordingly.

Q: Can we submit a work that was done (or submitted to a conference/journal)?

A: No. Only *substantial* work done (by all project team members) throughout the semester is eligible for a course project. If you already have a project in progress outside EECS 545, please provide concrete evidence of “Delta” made to this course project (any significant improvements, novel technical contributions, new dataset collected/evaluated, etc.), and we will check the validity of your statements through multiple sources available.

Q. If my results aren’t better than a known baseline, will I be penalized?

A. Not necessarily, although we would admit that there tends to be some positive correlation between the final performance of your approach and our ratings. Still, negative or unexpected results can be quite informative if you’ve made a thorough and good-faith effort. In general, we try to distinguish between two kinds of “negative” findings:

Insufficient-Effort Negative Results

Characteristics: Wrong assumptions, inadequate technical approaches, poor or minimal analysis.
Outcomes: These may indicate a lack of effort or planning, and will likely be viewed less favorably.

Thoughtful Negative Results

Characteristics: Plausible assumptions, solid methodology, careful experimentation, and a clear analysis of why the results fell short.
Outcomes: These can be very valuable for others to learn from. If your findings help future teams avoid similar pitfalls, or reveal important insights about why certain ideas don’t work, they can be considered a meaningful contribution.

Ultimately, what matters is the level of rigor and clarity in how you pursued your work and your documentation, not just the final performance numbers.

Changelog

2026/1/16 (rev1): Initial version