ROADMAP FOR S2

Timeline: 8 Weeks (February–March)
Core Goal: Publish a paper in a high-tier conference (preferably ACM/IEEE) or a mid/low-tier journal by the end of the semester.

STRATEGIC APPROACH

1. **Publication-Centric Focus**:
    - Every project must aim to address a **real-world research problem** in AI and align with current trends in conferences like NeurIPS, CVPR, or AAAI.
    - A mandatory collaboration between students (pairs/groups) ensures synergy of ideas.
2. **Research-Driven Projects**:
    - Each topic explored will lead to a **mini-research problem**, forming the basis for the paper.
    - Weekly deliverables: Research drafts (problem statement, methodology, partial results).
3. **Hands-On + Research Synergy**:
    - While learning theory, students will experiment with **cutting-edge tools and frameworks**.
    - Work will emphasize explainability, reproducibility, and novelty.
4. **Mentorship and Peer Reviews**:
    - Weekly paper reviews from peers and mentors to refine technical clarity and structure.
5. **Progress Milestones**:
    - Structured check-ins ensure steady progress, with focus on writing, experimentation, and paper refinement.

WEEKLY STRUCTURE

Week 1: Understanding Research Goals

- **Objective**: Define the **research problem** you want to solve.
- **Tasks**:
    - Identify gaps in the field by reviewing 3–5 conference/journal papers.
    - Select a theme: NLP, Computer Vision, Reinforcement Learning, or LLMs.
    - Outline a preliminary **problem statement** and hypothesis.
- **Deliverables**:
    - Research topic approval from mentors.
    - Shared reading list for the group.

Weeks 2–3: Building the Foundations

- **Objective**: Deep dive into foundational AI concepts and implement first prototypes.
- **Theory**:
    - Advanced ML/DL techniques (optimization strategies, loss functions, transfer learning).
    - Introduction to reproducible research practices: GitHub, Jupyter notebooks, and version control.
- **Hands-On Project**:
    - Implement baseline models for the research problem.
    - Evaluate results against datasets (use open benchmarks like CIFAR, IMDB, or MS COCO).
- **Research Focus**:
    - Identify potential **novel contributions** in your field (e.g., new architecture, improved metric, dataset augmentation).
- **Deliverables**:
    - Initial codebase and partial results with visualizations.
    - Paper section draft: Introduction + Related Work.

Weeks 4–5: Developing the Research Angle

- **Objective**: Expand on your problem and test unique solutions.
- **Theory**:
    - Advanced topics based on your research domain:
        - NLP: Transformer fine-tuning, attention mechanisms.
        - Vision: Vision transformers (ViTs), explainability (Grad-CAM).
        - Reinforcement Learning: Policy gradients, Q-learning.
        - LLMs: RAG, fine-tuning large models with LoRA or PEFT.
    - Learn evaluation metrics and reproducibility checks for academic rigor.
- **Hands-On Project**:
    - Prototype 2: Implement and evaluate your novel methodology.
    - Compare against existing baselines.
- **Research Focus**:
    - Analyze experimental results and iterate on the solution.
    - Draft core methodology section of the paper.
- **Deliverables**:
    - Working prototype with quantitative comparisons.
    - Research paper section draft: Methodology + Experiments.

Week 6: Writing, Refining, and Collaborating

- **Objective**: Focus on collaborative paper writing.
- **Tasks**:
    - Consolidate findings and ensure proper documentation (graphs, tables, charts).
    - Peer-review drafts within the group to ensure quality.
    - Focus on clarity, conciseness, and aligning with conference/journal formatting guidelines.
- **Deliverables**:
    - First complete draft of the research paper.
    - Code and dataset ready for submission (if required).

Week 7: Preparing for Submission

- **Objective**: Finalize your paper and prepare for presentation.
- **Tasks**:
    - Perform last-minute refinements (proofreading, formatting).
    - Conduct mock presentations to simulate conference paper defenses.
- **Deliverables**:
    - Final paper submitted to a high-tier conference or journal.
    - Presentation slide deck and research pitch.

Week 8: Advanced Topics and Research Showcase

- **Objective**: Explore additional areas and present findings to a wider audience.
- **Advanced Topics**:
    - Generative AI: GANs, diffusion models, multimodal models (e.g., CLIP).
    - Responsible AI: Bias, fairness, and explainability in AI research.
- **Tasks**:
    - Host an internal research symposium.
    - Present and discuss published papers and future research ideas.
- **Deliverables**:
    - Symposium presentations from each group.
    - Final workshop session: Lessons learned and roadmap for the next phase.

CHECKLIST BY THE END OF S2

1. **Research Output**:
    - Published paper in a conference or journal (minimum requirement).
2. **Technical Mastery**:
    - Competence in implementing and fine-tuning state-of-the-art AI techniques.
3. **Collaboration**:
    - Worked in a team to address a research problem.
4. **Communication**:
    - Presented research findings effectively to peers and mentors.
5. **Next-Level Goals**:
    - Identify follow-up research topics for S3 or internships.