Prodigal AI

AI Core Research

tat te 'nukampāṁ su-samīkṣamāṇo
bhuñjāna evātma-kṛtaṁ vipākam hṛd-
vāg-vapurbhir vidadhan namas te
jīveta yo mukti-pade sa dāya-bhāk

-Śrīmad-Bhāgavatam

yatra yogeśvaraḥ kṛṣṇo
yatra pārtho dhanur-dharaḥ
tatra śrīr vijayo bhūtir
dhruvā nītir matir mama

-Bhagavad Gītā

Wherever there is Krishna, the master of all mystics, and wherever there is Arjuna, the supreme archer, there will also certainly be opulence, victory, extraordinary power, and morality. That is my opinion.

Founder's Message

Prodigal AI, was named with the blessed spirit of a warrior. For many times in life we are all knocked down, not knowing how to get through the next day, what the next morning will bring? Prodigal AI is no different. We have seen the similar motion of life's pendulum as everyone experiences. But we have always imbibed the values of assessment, planning and action. Even when the going has been tough, we have aimed for the highest quality of research, solving challenging problems, breaking the barriers of innovation, for it has reaped us great laurels in this journey of wisdom.

From various journal publications to winning National AI Awards, we have taken each step with courage and determination. As the current leader of the firm, I offer you sincere greetings for joining us on this journey. We hope to make it one of the best research and learning experiences you have. For your action of walking through this joruney with us, we hope to repay you with great determination and satisfaction of learning top-notch industry skills.

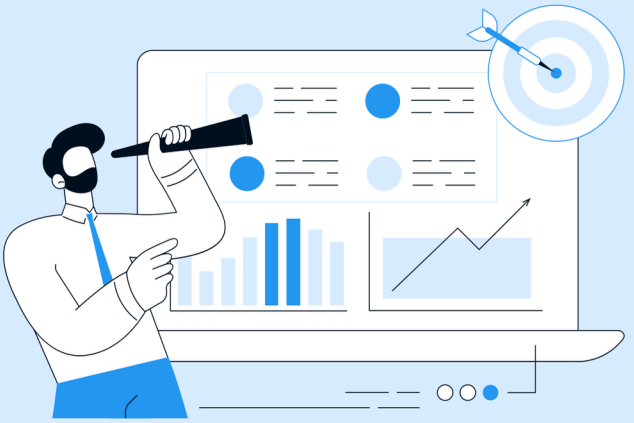
Nishchal

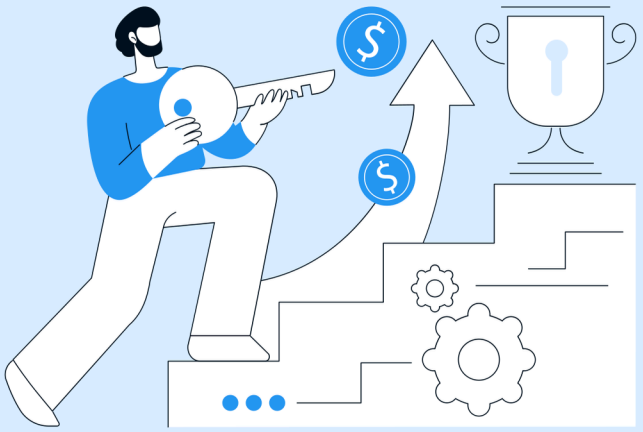
Nishchal Gaba
CEO & Founder

Mission & Vision

Mission Statement

Innovating technology like an artist at work, we develop solutions that touches hearts and transforms lives, one meaningful product at a time.





Vision Statement

To be recognized as the #1 AI and Blockchain startup in India, shaping groundbreaking innovations that meet the highest global standards and inspire trust and impact worldwide.

6 months training program
AI Core Research
(Zero to Hero in AI Mathematics, Coding & Framework Building)

Day 1-15: Foundational Mathematics & AI Fundamentals

Topics Covered:

- Mathematical Foundations:
  - Linear algebra (matrix operations, eigenvalues/eigenvectors), calculus (differentiation, integration), probability, and statistics.
- Coding Exercises:
  - Implementing basic linear algebra routines and probability simulations using NumPy and pandas.

Hands-on Tasks:

- Solve mathematical problems and document solutions in Jupyter Notebooks.
- Write Python scripts to demonstrate matrix operations and gradient calculations.

Deliverables:

- A summary report on foundational mathematics for AI.
- Annotated coding notebooks and a public GitHub repository with initial exercises.

Day 16-30: Advanced Mathematics for AI

Topics Covered:

- Optimization Techniques:
  - Gradient descent variants (SGD, Adam, RMSProp), convex optimization, and duality theory.
- Theoretical Derivations:
  - Detailed proofs of update rules and convergence analyses.

Hands-on Tasks:

- Implement optimization algorithms from scratch and compare with library implementations.
- Derive and document convergence proofs in a LaTeX document.

Deliverables:

- A detailed research document with mathematical proofs and Python notebooks.
- A public blog post tutorial with code demonstrations.

Day 31-45: Theoretical Frameworks in Machine Learning

Topics Covered:

- Statistical Learning Theory:
  - Bias-variance trade-off, VC-dimension, and overfitting/underfitting.
- Kernel Methods & SVMs:
  - Detailed exploration of support vector machines and decision boundaries.

Hands-on Tasks:

- Implement SVMs and kernel methods using scikit-learn and custom code.
- Analyze bias-variance trade-offs with experiments.

Deliverables:

- A draft research paper with detailed mathematical derivations.
- Code demonstrations and a public GitHub repository containing experiments.

Day 46-60: Deep Learning Theory

Topics Covered:

- Neural Networks:
  - Architecture design, backpropagation, activation functions, and convergence analysis.
- Challenges:
  - Addressing vanishing/exploding gradients and analyzing CNNs, RNNs, and transformers.

Hands-on Tasks:

- Develop sample neural networks in TensorFlow and PyTorch.
- Visualize gradient flows and convergence curves.

Deliverables:

- A comprehensive whitepaper and research report with mathematical derivations.
- Sample code implementations and visualizations hosted in a public repository.

Day 61-75: Advanced Topics in AI Research

Topics Covered:

- Generative Models:
  - In-depth study of Variational Autoencoders (VAEs) and Generative Adversarial Networks (GANs).
- Challenges:
  - Loss functions, regularization, and mode collapse in GANs.

Hands-on Tasks:

- Implement a simple VAE and GAN, analyze training stability, and experiment with loss adjustments.

Deliverables:

- A detailed research report and public blog tutorial with complete code examples.
- Presentation slides summarizing theoretical insights and experimental findings.

Day 76-90: Framework Building & Modular Code Architecture

Topics Covered:

- Custom AI Frameworks:
  - Designing modular, reusable code architectures for research experiments.
- Best Practices:
  - Dependency injection, design patterns, and extensibility.

Hands-on Tasks:

- Architect and implement a custom AI research framework with clearly defined modules.
- Document the code structure and contribution guidelines.

Deliverables:

- An initial code structure for the custom AI framework on GitHub.
- A detailed design document (with Draw.io diagrams) and public documentation.

Day 91-105: Experimentation & Reproducibility

Topics Covered:

- Reproducible Research:
  - Best practices for experiment tracking, version control, and environment management.
- Tools:
  - Docker and DVC for data versioning and experiment reproducibility.

Hands-on Tasks:

- Create reproducible experiment scripts and integrate them with version control.
- Document the experiment process and challenges in a blog post.

Deliverables:

- A public GitHub repository with reproducible experiment code.
- A research report on best practices for reproducibility and a detailed blog tutorial.

Day 106-120: Performance Evaluation & Benchmarking

Topics Covered:

- Evaluation Metrics:
  - Standard metrics (accuracy, F1 score, precision, recall) and task-specific measures.
- Benchmarking Pipelines:
  - Automating evaluations and comparing models using standard datasets.

Hands-on Tasks:

- Develop evaluation pipelines and benchmark several AI models.
- Analyze and visualize performance data.

Deliverables:

- A comprehensive benchmarking report with integrated code and charts.
- A public blog tutorial on setting up evaluation pipelines, with code examples.

Day 121-135: Scalability in AI Research

Topics Covered:

- High-Performance Computing:
  - Parallel processing, GPU/TPU utilization, and distributed training frameworks (e.g., Horovod, PyTorch DDP).
- Challenges:
  - Scaling experiments and managing resource allocation.

Hands-on Tasks:

- Set up distributed training experiments and document performance improvements.
- Create architecture diagrams to illustrate distributed setups.

Deliverables:

- A research report on scalability strategies with supporting code examples.
- Detailed architecture diagrams (Draw.io) and a public GitHub repository.

Day 136-150: Peer Review & Collaborative Research

Topics Covered:

- Academic Writing:
  - Structuring research papers, best practices in drafting and revising.
- Peer Review Processes:
  - Conducting internal peer reviews and simulating conference reviews.

Hands-on Tasks:

- Draft a research paper and organize peer review sessions.
- Incorporate feedback into iterative improvements.

Deliverables:

- A draft research paper with accompanying presentation slides.
- Internal peer review reports and a public blog post describing the process.

Day 151-165: Exploration of Novel AI Algorithms

Topics Covered:

- Innovation in AI:
  - Identifying gaps in current literature and proposing new approaches.
- Proof-of-Concept:
  - Designing experiments to test emerging algorithms or architectures.

Hands-on Tasks:

- Develop a detailed research proposal including methodology, experiments, and expected outcomes.
- Prototype a novel algorithm or architecture and document initial results.

Deliverables:

- A detailed research proposal document with methodology and preliminary experimental results.
- A public GitHub repository with prototype code and detailed documentation.

Day 166-180: Finalization & Dissemination

Topics Covered:

- Final Revisions:
  - Polishing the research paper, finalizing experiments, and preparing for dissemination.
- Outreach:
  - Organizing internal symposiums or webinars and preparing conference submissions.

Hands-on Tasks:

- Finalize the research paper and presentation materials.
- Develop a dissemination plan including future work.

Deliverables:

- A final research paper ready for submission, along with conference presentation slides.
- A public blog post summarizing the research journey, comprehensive documentation, and a roadmap for future work.

Tech Stack:

- Languages & Tools:
  - Python, Julia, MATLAB
- Mathematical Libraries:
  - NumPy, SciPy, Sympy
- Deep Learning Frameworks:
  - TensorFlow, PyTorch
- Development & Documentation:
  - Jupyter Notebooks, LaTeX, Git, Overleaf
- Visualization:
  - Matplotlib, Seaborn
- Reproducibility & Containerization:
  - Docker, CI/CD tools (GitHub Actions)

Character & Competence

At Prodigal AI, we deeply believe in the two pillars of Character and Competence. Competence may bring skill and efficiency, but without character, it can never achieve true greatness. On the other hand, character alone, while admirable, cannot translate into meaningful achievements without the right competence to back it up. It is the harmony of these two values that propels us forward.

As we continue on our journey, we remind ourselves that every step, no matter how challenging, is an opportunity to refine both our character and our competence. Greatness is not achieved overnight, but with persistence, integrity, and relentless improvement, we know we will continue to make a lasting impact. Let's keep pushing forward, knowing that the pursuit of excellence, when anchored in strong values, leads to true success.