PANIMALAR ENGINEERING COLLEGE
An Autonomous Institution

[JAISAKTHI EDUCATIONAL TRUST]

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INDIA'S WOMEN CENTRIC NATIONAL LEVEL 24 – HOUR HACKATHON
TECHDIVATHON – 2.0
She blooms. She leads. She conquers

Domain:AIML
Problem Statements:

S.No	Title	Problem Statement	Description
1	Indic Scripture-Based Small Behavioral Model for Empathy Detection (AI)	Current AI lacks culturally grounded empathy measurement rooted in Indic wisdom traditions, relying on Western algorithms and LLMs.	Develop a Small Behavioral Model (SBM) codifying empathy as defined in Indic scriptures (Bhagavad Gita, Upanishads, etc.) using rule-based pattern recognition and symbolic reasoning to detect and quantify empathetic behaviors in users through game/social platform interactions, independent of modern LLMs
2	AI-Driven Quantum Error Correction Optimizer	Quantum computers suffer high error rates preventing practical applications.	Create reinforcement learning agents that dynamically optimize quantum error correction codes based on real-time qubit error patterns and noise profiles.
3	Neuromorphic Hardware for Edge AI Inference	Current edge AI chips consume excessive power for real-time inference.	Design spiking neural network architectures mimicking brain efficiency for ultra-low power object detection on battery-constrained IoT devices.
4	AI Constitutional Alignment Framework	Advanced AIs risk developing misaligned objectives during training.	Build multi-agent debate systems where AI models argue against their own reward functions, iteratively refining toward human value alignment.
5	Generative AI for Synthetic Benchmark Dataset Creation	ML benchmarks suffer distribution shift between training and real-world data.	Generate infinite synthetic datasets matching target distributions with controllable difficulty ramps for robust model evaluation.
6	Self-Supervised Learning for Zero-Shot Code Translation	Code translation models require expensive parallel corpora across languages.	Develop contrastive learning on massive unlabelled codebases enabling translation between unseen programming languages through semantic understanding.
7	AI-Powered Automated Theorem Proving Assistant	Mathematical proofs remain human-crafted despite formal verification needs.	Create transformer models trained on Lean proofs that autonomously generate, verify, and simplify complex mathematical proofs from natural language conjectures.

8	Diffusion Models for 3D Molecular Structure Generation	Traditional molecular generators produce unrealistic 3D conformations.	Apply denoising diffusion to generate physically realistic protein-ligand complexes satisfying quantum mechanical constraints.
9	AI-Driven Hardware Trojan Detection in Supply Chains	Malicious hardware implants evade traditional post-silicon testing.	Develop graph neural networks analyzing chip layouts and timing signals to detect stealthy hardware trojans during manufacturing.
10	Continual Learning Without Catastrophic Forgetting	Sequential model training destroys performance on previous tasks.	Design elastic weight consolidation with dynamic network expansion enabling lifelong learning across thousands of sequential tasks.
11	Graph Neural Networks for Protein-Protein Interaction Prediction	Protein interaction prediction accuracy limits drug target discovery.	Build message-passing GNNs incorporating evolutionary, structural, and physicochemical features for 95% accurate PPI prediction.
12	Transformer-Based Time Series Anomaly Detection	Traditional anomaly detection fails on multivariate seasonal data.	Apply attention mechanisms to capture long-range temporal dependencies in industrial sensor data for zero-shot anomaly localization.
13	Reinforcement Learning for Compiler Optimization	Hand-crafted compiler heuristics miss optimal code generation opportunities.	Train RL agents to reorder instruction scheduling and register allocation maximizing runtime performance across architectures.
14	Contrastive Learning for Self-Supervised Audio Representation	Audio pretraining requires expensive labeled datasets.	Develop SimCLR-style pretext tasks on unlabeled audio enabling transfer learning to speech recognition and music generation.
15	Bayesian Neural Networks for Uncertainty Quantification	Deterministic NNs provide overconfident wrong predictions.	Implement variational inference in BNNs quantifying epistemic uncertainty for safety-critical medical diagnosis applications.
16	Meta-Learning for Few-Shot Image Classification	Models require thousands of examples per class for accuracy.	Train models learning to learn from 1-5 examples using MAML optimization across diverse visual domains.
17	Causal Inference with Double Machine Learning	Confounding biases invalidate observational treatment effect estimates.	Combine ML propensity modeling with outcome prediction for unbiased causal effect estimation from observational data.
18	Spectral Clustering for Single-Cell RNA Sequencing	scRNA-seq data reveals complex cell type mixtures requiring nonlinear separation.	Apply Laplacian eigenmaps discovering manifold structure for accurate cell type deconvolution.
19	Gaussian Processes for Hyperparameter Optimization	Grid search fails exploring high-dimensional hyperparameter spaces efficiently.	Use Bayesian optimization with GP surrogate models minimizing validation loss across ML pipeline configurations.
20	AI-Driven Hardware Trojan Detection in Supply Chains	Malicious hardware implants evade traditional post-silicon testing.	Develop graph neural networks analyzing chip layouts and timing signals to detect stealthy hardware trojans during manufacturing.
21	All-Weather, High-Confidence Debris Mapping	The challenge is to overcome cloud obscuration and false positives (like seaweed) to create reliable, daily maps of floating macro-plastic debris	Multi-Modal Data Fusion Architecture: Develop a Deep Learning model that fuses spectral features from Optical Imagery with shape and roughness data from Synthetic Aperture Radar (SAR) to

		aggregations in complex coastal and open ocean environments.	achieve high precision and all-weather capability.

Reviewer's Digital Signature

Reviewer's Name:
Position:
Organization:
Date:

Digital Signature: