# JAYADEV NARAM

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#### **EDUCATION**

## **IIIT Hyderabad**

B.Tech and MS by Research in Computer Science MS Thesis adviced by Dr. Pawan Kumar Title: Applications of Riemannian Optimization to Machine Learning Problems

#### **EXPERIENCE**

## **CSTAR, IIITH**

Undergrad Research Assistant

 Worked on the applications of Optimization Methods on Matrix-Manifolds to Machine Learning problems such as Extreme Classification, Tensor Completion problem, where the underlying geometry of the constrained space is exploited to propose novel Riemannian algorithms.

## **IHub-Data**

Research Fellow

• Received Research Grant for the project titled "Optimization Models & Solvers for recommendation with additional feedback or constraints for high dimensional tensor data".

## **IIIT Hyderabad**

Teaching Assistant

- Topics in Applied Optimization Monsoon 20', 21'
- Advanced Optimization Spring 22'

*Responsibilities:* Taking tutorial sessions, setting problem sets for guizzes and assignments and their evaluation.

## PROJECTS

## **Generalized Structured Low-Rank Tensor Completion**

- Proposed a Riemannian solver based on the dual formulation to Tensor Completion problem which have lowrank and structure constraints. Proved duality gap and experimentally verified the correctness of the proposed algorithm. Accepted to OPT 2021, NeurIPS workshop.
- Extended our formulation to consider a general convex low-rank regularizer and have shown theoretically that the duality gap approaches zero.
- An efficient algorithm was implemented using MANOPT for the special case of nonnegative constraints. Experiments were carried out on color images, hyperspectral datasets and video datasets. Accepted to WACV 2022.

## **Riemannian approach to Extreme Classification**

 Proposed and implemented a Riemannian solver to the baseline SLEEC algorithm to solve Extreme Classification problem using MANOPT. Accepted to CODS-COMAD 2022.

## **Deflation Preconditioner for Large Sparse Linear systems**

- Worked on an implicitly restarted Lanczos type algorithm to compute approximate extreme eigenvectors of a symmetric positive definite matrix and proposed a deflation preconditioner from the approximate eigenvectors to efficiently solve linear systems.
- Implemented a dense variant of the solver in MATLAB and a sparse variant C++ using EIGEN and Ceres-Solver libraries.

July 2017 – Present CGPA - 8.09

April 2019 – Present

Aug 2021 – July 2022

Aug 2020 – May 2022

June 2021 - March 2022

Sept 2019 - Aug 2020

Sept 2020 - April 2021

#### **Riemannian Preconditioning**

• Worked on a preconditioning approach to Optimization problems on Manifold and explored its applications to Linear Discriminant Analysis and Principle Component Analysis problems.

## PUBLICATIONS

- J. Naram, T. K. Sinha, P. Kumar. "A Riemannian Approach to Extreme Classification Problems." CODS-COMAD, 2022.
- J. Naram, T. K. Sinha, P. Kumar. "Structured Low-Rank Tensor Learning", OPT Workshop, NeurIPS 2021.
- T. K. Sinha, J. Naram, P. Kumar. "Nonnegative Low-Rank Tensor Completion via Dual Formulation With Applications to Image and Video Completion", WACV, 2022.

## **TECHNICAL SKILLS**

- Numerical Linear Algebra EIGEN, Ceres-Solver, MANOPT, MATLAB
- Programming Python, C, C++
- Web Development HTML, CSS, Javascript, ReactJS, Go
- Miscellaneous GIT, Bash, LATEX

## **RESEARCH INTERESTS**

Riemannian Optimization • Optimization for Large-Scale Machine Learning • Low-Rank Tensor Completion • Extreme Classification • Convex Analysis • Variational Analysis • Saddle point problem • Numerical Linear Algebra.

#### ACHIEVEMENTS

- Shortlisted for participating in "Research Week with Google", conducted by Google Research India during Feb 8-11, 2022.
- External Reviewer for ECML-PKDD 2022.
- Dean's List Award for Academic Performance (top 5% of the class) for 2020-2021 Spring Semester.
- Listed in top 0.07% in JEE Mains, 2017 and top 5% in JEE Advanced, 2017