

# Mathematical Sciences Colloquium Series

## Fall 2022



**Dr. Frank Hsu**  
Fordham University

📍 **In person at Bell Hall 130 and online via Zoom**

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📅 **Friday, October 28** ⌚ **1pm**

## Combinatorial Fusion Algorithm (CFA): A New ML/AI paradigm for Robust Informatics and Data/Computational Sciences

### Abstract

Since it was proposed (Hsu, Chung, and Kristal (2006)), Combinatorial Fusion Algorithm (CFA) has been used in a variety of subjects and disciplines including: informatics (e.g.: biomedical-, chemo-, and financial-), virtual screening (and drug discovery), information and communication technology (e.g.: internet search, recommender systems, wireless network selection, target tracking, information and cyber security), high-throughput experiment (HTE) (and material science), and cognitive neuroscience (e.g.: preference detection and joint decision making).

In this talk, I will cover a few distinctive advantages of CFA over traditional statistical/computational learning and modeling systems:

- (a) CFA considers both score function and rank function as well as score and rank combinations in dual space (score function and score combination in Euclidean space vs. rank function and rank combination in permutation space);
- (b) CFA uses the rank-score characteristic (RSC) function to characterize a scoring system (Hsu, Shapiro, and Taksa (2002) and Hsu and Taksa (2005)) and cognitive diversity (CD(A,B)) to measure the diversity or dis-similarity between two scoring systems A and B (Hsu, Kristal, and Schweikert (2010) and Hsu et al (2019));
- (c) CFA facilitates unsupervised learning in ensemble methods, attribute combination, and model fusion for robust ML/AI (Tang et al (2021));
- (d) Multilayer combinatorial fusion (MCF) provides a method and practice for deep reinforcement learning on the Kemeny metric space, a generalization of the permutation space, where tied rankings are allowed (Hurley et al (2020)).

In addition, we will discuss issue of explainability as well as identifying and managing bias in ML/AI using CFA and MCF.

**For further information, please contact Dr. Christina Mariani, [mcmariani@utep.edu](mailto:mcmariani@utep.edu)**