

# Mean-Field Type Games

Hamidou Tembine \*

\* SRI - Center for Uncertainty Quantification in Computational Science & Engineering CEMSE, KAUST (e-mail: [tembine@ieee.org](mailto:tembine@ieee.org)).

Over the last decade, key social networking needs in growth areas such as smart cities, social networks, risk management of nuclear waste, corrosion failure detection, pollution control, cloud-based auction mechanism have motivated extensive research on learning, analysis and optimization of complex distributed systems across all science and engineering disciplines. From a game-theoretic point of view, the distinguishing feature of distributed systems is that they give rise to nonlinear interaction problems that involve mean-field term.

## OBJECTIVES

The objective of this tutorial will be to present a thorough overview of these mean field techniques and their applications.

Goal: To present to graduate students, researchers and engineers advanced techniques for learning, control and games of mean-field type

## TENTATIVE PROGRAM (3H+BREAK)

- Introduction (10mn)
- Static mean-field games: aggregative games (20mn)
- Mean-field learning (30mn)
  - Public good provisioning in smart cities
  - Satisfactory solutions in crowd-averse cyber-physical systems
- Single player mean-field type games (30mn)
  - Risk management of nuclear waste
  - Failure probability of corrosion
- Non-cooperative mean-field type games (30mn)
  - Reacting to the interference field in small-cell wireless networks
  - Network security: malware propagation in opportunistic networks
- Cooperative mean-field type games (30mn)
  - Shallow lake pollution control and fishing industry
- Nonasymptotic mean-field games (30mn)
  - Mobile advertisement auctions in heterogeneous and asymmetric bidders

Representative examples will be used throughout to illustrate the techniques. Throughout the tutorial, unresolved issues both in the theoretical and the application side will be discussed.

## SHORT BIOGRAPHY

Hamidou Tembine received his M.S. degree from Ecole Polytechnique and his Ph.D. degree from University of Avignon. His current research interests include evolutionary games, mean field stochastic games and applications. He was the recipient of 5 best paper awards and has co-authored two books.