

Editorial

WELCOME to the third issue of the JOURNAL ON SELECTED AREAS IN INFORMATION THEORY (JSAIT), focusing on “Estimation and Inference” in modern information sciences.

Information Theory, since its inception, has been primarily driven by applications of reliable communication. While many interesting questions in Information Theory, inspired by the desire of achieving high throughput, low latency reliable communication, remain partially unresolved, it is fair to state that it has made a significant impact on the practice of modern communications over the years, e.g., techniques such as OFDM and MIMO have roots in information theory. This is further self-evident in the fact that modern communication systems have allowed many of us to continue working remotely in the unprecedented times of the COVID-19 pandemic, including this project.

This success of Information Theory is in part due to the elegant mathematical abstraction that in effect renders the question of reliable communication as one of “Estimation and Inference” over any physical communication medium. Indeed, for this very reason, methods, tools and techniques primarily rooted in Information Theory have impacted questions that are traditionally considered to be part of Statistics. In turn, Statistics has fueled progress in Information Theory. Examples include the role of mutual information in independence testing leading to efficient algorithms for learning graphical models, Fano’s inequality leading to identification of statistical limits, or even “entropic” optimization characterizing asymptotic graph properties.

While this “conversation” between Information Theory, Statistical Estimation and Inference has been playing in the background, a new breed of researchers has brought it to the forefront. The goal of this special issue is to precisely put a spotlight on this. In this issue, we have 22 papers ranging from topics including matrix and tensor estimation, ranking and bandit, communication efficient optimization, graphical models, parameter estimation and classification in high-dimensional setting, differential privacy and group testing, clustering, hypothesis testing and MIMO communication.

Many people contributed to the success of this project by working with focus and diligence in the middle of

the pandemic. This issue would not have been possible without the vision and enthusiasm of the journal’s Editor-in-Chief, Andrea Goldsmith, and the expertise and commitment of the guest editors Guy Bresler (MIT), John Duchi (Stanford), Po-Ling Loh (UW-Madison), Yihong Wu (Yale) and Christina Lee Yu (Cornell). The lead guest editor, Devavrat Shah (MIT), would especially like to thank all the guest editors who continued working diligently to get it together while some became new parents, some became “zoom observers” for their young kids, some juggled multiple responsibilities, some planned changing continents, and more. Finally, Alison Larkin at IEEE deserves special mention for providing relentless help to keep us on schedule.

The project started right around the beginning of the pandemic. Based on our “Estimation and Inference” of the state of the world, we hope that you will be reading this issue as we look forward to getting back to “normal” times.

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