

## Contexts can be Cheap: Solving Stochastic Contextual Bandits with Linear Bandit Algorithms

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**VENUE** CS Seminar Room, Y6405, 6/F., Yellow Zone, Yeung Kin Man Academic Building, City University of Hong Kong 83 Tat Chee Avenue, Kowloon Tong (Zoom link: <https://cityu.zoom.us/j/94040436732>)

### ABSTRACT

Linear bandit and contextual linear bandit problems have recently attracted extensive attention as they enable to support impactful active learning applications through elegant formulations. In linear bandits, a learner selects an action from a fixed action space at each round and receives a reward determined by the inner product of the action and an unknown parameter vector, plus noise. Contextual linear bandits introduce an additional layer of complexity by allowing the action space to vary at each round, thereby capturing context. The goal is to design an algorithm that learns to play as close as possible to the unknown optimal policy after a number of action plays. The contextual problem is considered more challenging than the linear bandit problem, which can be regarded as a contextual bandit problem with a fixed context. Surprisingly, in this talk, we show that the stochastic contextual problem can be solved as if it is a linear bandit problem. To accomplish this, we present a novel reduction framework that transforms any stochastic contextual linear bandit instance into a linear bandit instance. Our reduction framework opens up a new way to approach stochastic contextual linear bandit problems, and enables significant savings in communication cost in distributed setups. Furthermore, it yields improved regret bounds in a number of instances.

### BIOGRAPHY

Osama A. Hanna is a Ph.D. candidate in the Electrical and Computer Engineering Department at the University of California, Los Angeles (UCLA). He received his BS and MS degrees in electrical engineering from the Faculty of Engineering Cairo University and Nile University in Egypt in 2014 and 2018 respectively. He received the Award of Excellence from Cairo University in 2014. He received the Masters Fellowship and a graduate Research Assistantship from Nile University for the years 2014-2018, and Marie Skłodowska-Curie Fellowship for the year of 2017. He received the Electrical and Computer Engineering Department Fellowship from UCLA for the year 2018/2019. His research interests are machine learning, information theory and mathematics.

### All are welcome!



In case of questions, please contact Dr Lingqi Song at [lingqi.song@cityu.edu.hk](mailto:lingqi.song@cityu.edu.hk), or visit the CS Departmental Seminar Web at <https://www.cs.cityu.edu.hk/events/cs-seminars/recent-cs-colloquia>.