Tuan Nguyen

PhD at UofA | Bandits Researcher | Math & Logic

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Scholar Github Linkedin

Education

University of Arizona, Tucson, AZ Aug. 2022 – Present
Ph.D. in Computer Science
Advisor: Prof. Kwang-Sung Jun
Research: Adaptive Decision-making Algorithms, Bandits Algorithms, Monte Carlo Tree Search, RL

University of Oregon, Eugene, OR Aug. 2019 – June. 2021
M.S. in Computer Science
Advisor: Prof. Thien Huu Nguyen
Research: Domain Adaptation, Unsupervised and Self Learning, Multilingual NLP

CUNY Baruch College, New York, NY Aug. 2013 – Dec. 2015
B.A. in Finance; minor in Mathematics
Competitions: Top 20 at Traders@MIT Fall 2014 Trading Competition, CUNY Maths Competition

Research Interests

- My research centers on adaptive decision-making algorithms, including bandit algorithms, Monte Carlo Tree Search, and Reinforcement Learning. In particular, my work focuses on developing algorithms that provably adapt to the difficulty and complexity of particular problem instances, and perform optimally in worst-case and/or adversarial scenarios.
- I am interested in work opportunities related to recommendation systems, personalization, best-arm identification, agent planning, as well as autonomous vehicles and robotics.

Research Projects

HAVER: Instance-Dependent Error Bounds for Maximum Mean Estimation and Applications to Q-Learning and Monte Carlo Tree Search (in submission to AISTATS 2025)

- We investigate the problem of estimating the largest mean among K distributions based on sample data, a key routine in Q-Learning (during Q-value updates) and Monte Carlo Tree Search (during node-value updates).
  - Setup: consider K subgaussian distributions with means $\mu_1 \geq \ldots \geq \mu_K$. Each dist i gives N_i samples.
  - Goal: estimate $\max_{i\in[K]} \mu_i$ without knowledge of the μ_i values.
  - Metric: analyze estimator in terms of mean squared error (MSE). First paper to provide such analysis.
- We propose a novel estimator, called **Head AVERaging (HAVER)**, which satisfies two criteria:
  - Perform as well as an oracle that knows the identity of the optimal arm; oracle's MSE being $\tilde{\mathcal{O}}\left(\frac{1}{N_1}\right)$.
  - Able to achieve instance-dependent accelerated rates in various problems.
- In comparison, the standard largest empirical mean estimator (LEM), defined as $\hat{\mu}^{\text{LEM}} := \max_i \hat{\mu}_i$, performs worse than the oracle's MSE.
- Furthermore, we conduct empirical studies in standard multi-armed bandits (MAB) settings and reinforcement learning environments, demonstrating that HAVER consistently outperforms well-known estimators, including double estimator, weighted estimator, and maxmin estimator.

Fixing the Loose Brake: Exponential Tail for Stopping Time in Best Arm Identification (in submission to AISTATS 2025)

- In the best-arm indentification with fixed confidence (FC-BAI) setting, there is currently no provable guarantee that a FC-BAI algorithm will stop.
  - In particular, we show that, with a very small probability, the popular Successive Elimination algorithm may fail to stop.
- In this paper, we provide a stronger guarantee that any FC-BAI algorithm having a **exponential stopping tail** property will eventually stop.
  - A FC-BAI algorithm is said to have a (T_δ, κ)-exponential stopping tail, if there exists a time step T_δ and a problem-dependent constant $\kappa > 0$ such that for all $T \geq T_\delta$, $\mathbb{P}(\tau \geq T) \leq \exp\left(-\frac{T}{\kappa \cdot \text{polylog}(T)}\right)$.
  - If a FC-BAI algorithm has the exponential stopping property, it will eventually stop, i.e., $\mathbb{P}(\tau < \infty) = 1$.
- We prove that Doubling Sequential Halving with fixed confidence (FC-DSH) has an $(\tilde{\Theta}(H_2 \log(1/\delta)), \tilde{\mathcal{O}}(H_2))$-exponential stopping tail, where $H_2 = \max_{i\geq 2} i\Delta_i^{-2}$ is the standard instance-dependent sample complexity measure in FC-BAI.
- We propose a novel meta-algorithm, called BrakeBooster, which transforms a black-box FC-BAI algorithm equipped with the standard guarantees into one that has an exponential stopping tail property.

* When we run BrakeBooster with Successive Elimination algorithm, then it enjoys $(\tilde{\Theta}(H_2 \log(1/\delta), \tilde{\mathcal{O}}(H_2))$-exponential stopping tail.

Publications

Crosslingual Transfer Learning for Relation and Event Extraction via Word Category and Class Alignments
Minh Van Nguyen, Tuan Ngo Nguyen, Bonan Min, and Thien Huu Nguyen
In Proceedings of the EMNLP 2021

Event Detection: Gate Diversity and Syntactic Importance Scores for Graph Convolution Neural Networks
Viet Dac Lai, Tuan Ngo Nguyen, and Thien Huu Nguyen
In Proceedings of the EMNLP 2020

Graph Transformer Networks with Syntactic and Semantic Structures for Event Argument Extraction
Amir Pouran Ben Veyseh, Tuan Ngo Nguyen, and Thien Huu Nguyen
In Findings of the EMNLP 2020

Academic Services

Teaching Assistant: CSC445 Design and Analysis of Algorithms, CSC380 Principles of Data Science.

Knowledge and Skills

Knowledge: Bandits Algorithms, Monte Carlo Tree Search, Markov Decision Processes, Reinforcement Learning, ML Theory, Concentration Measures, Probabilistic Models, Statistics.
Technical Skills: Python, C/C++, Julia, Pytorch/Tensorflows, MathLab, SQL; **Editor**: Emacs.
Other related keyworks: Best-arm Identification (BAI), Recommendation System, Personalization, A/B Testing, Thompson Sampling.