

REFERENCES

- [1] Itai Ashlagi and Mark Braverman. 2009. Ascending Unit Demand Auctions with Budget Limits. *Technical Report* (2009).
- [2] Itai Ashlagi, Mark Braverman, Avinatan Hassidim, Ron Lavi, and Moshe Tennenholtz. 2010. Position Auctions with Budgets: Existence and Uniqueness. *The B.E. Journal of Theoretical Economics* 10, 1 (2010).
- [3] Lawrence M. Ausubel and Paul Milgrom. 2006. The Lovely but Lonely Vickrey Auction. In *Combinatorial Auctions, chapter 1*. MIT Press.
- [4] Sayan Bhattacharya, Gagan Goel, Sreenivas Gollapudi, and Kamesh Munagala. 2012. Budget-Constrained Auctions with Heterogeneous Items. *Theory of Computing* 8, 20 (2012), 429–460.
- [5] Garrett Birkhoff. 1946. Three observations on linear algebra. *Univ. Nac. Tucuman. Revista A* 5 (1946), 147–151.
- [6] Christian Borgs, Jennifer Chayes, Nicole Immorlica, Mohammad Mahdian, and Amin Saberi. 2005. Multi-unit Auctions with Budget-constrained Bidders. In *Proceedings of the 6th ACM Conference on Electronic Commerce*. 44–51.
- [7] Yang Cai, Constantinos Daskalakis, and S. Matthew Weinberg. 2012. An algorithmic characterization of multi-dimensional mechanisms. In *Proceedings of the 44th ACM Symposium on Theory of Computing*. 459–478.
- [8] Yang Cai, Constantinos Daskalakis, and S. Matthew Weinberg. 2012. Optimal Multi-dimensional Mechanism Design: Reducing Revenue to Welfare Maximization. In *Proceedings of the 53rd IEEE Symposium on Foundations of Computer Science*. 130–139.
- [9] Yang Cai, Constantinos Daskalakis, and S. Matthew Weinberg. 2013. Understanding Incentives: Mechanism Design Becomes Algorithm Design. In *Proceedings of the 54th IEEE Symposium on Foundations of Computer Science*. 618–627.
- [10] Shuchi Chawla, David L. Malec, and Azarakhsh Malekian. 2011. Bayesian Mechanism Design for Budget-constrained Agents. In *Proceedings of the 12th ACM Conference on Electronic Commerce*. 253–262.
- [11] Yeon-Koo Che and Ian Gale. 1998. Standard Auctions with Financially Constrained Bidders. *The Review of Economic Studies* 65, 1 (1998), 1–21.
- [12] Yeon-Koo Che and Ian Gale. 2000. The Optimal Mechanism for Selling to a Budget-Constrained Buyer. *Journal of Economic Theory* 92, 2 (2000), 198–233.
- [13] Riccardo Colini-Baldeschi, Stefano Leonardi, Monika Henzinger, and Martin Starnberger. 2015. On Multiple Keyword Sponsored Search Auctions with Budgets. *ACM Trans. Econ. Comput.* 4, 1, Article 2 (Dec. 2015), 2:1–2:34 pages.
- [14] Vincent Conitzer and Tuomas Sandholm. 2002. Complexity of Mechanism Design. In *Proceedings of the Eighteenth Conference on Uncertainty in Artificial Intelligence*. San Francisco, CA, USA, 103–110.
- [15] Shahar Dobzinski, Ron Lavi, and Noam Nisan. 2008. Multi-unit Auctions with Budget Limits. In *Proceedings of the 2008 49th Annual IEEE Symposium on Foundations of Computer Science*. Washington, DC, USA, 260–269.
- [16] Paul Dütting, Zhe Feng, Harikrishna Narasimhan, and David C. Parkes. 2017. Optimal Auctions through Deep Learning. *CoRR* abs/1706.03459 (2017).
- [17] Paul Dütting, Felix A. Fischer, Pichayut Jirapinyo, John K. Lai, Benjamin Lubin, and David C. Parkes. 2012. Payment rules through discriminant-based classifiers. In *Proceedings of the 13th ACM Conference on Electronic Commerce*.
- [18] Paul Dütting, Monika Henzinger, and Martin Starnberger. 2015. Auctions for Heterogeneous Items and Budget Limits. *ACM Trans. Econ. Comput.* 4, 1, Article 4 (2015), 4:1–4:17 pages.
- [19] Paul Dütting, Monika Henzinger, and Ingmar Weber. 2011. An Expressive Mechanism for Auctions on the Web. In *Proceedings of the 20th International Conference on World Wide Web*. 127–136.
- [20] Noah Golowich, Harikrishna Narasimhan, and David C. Parkes. 2018. Deep Learning for Multi-Facility Location Mechanism Design. In *Proceedings of the 27th International Joint Conference on Artificial Intelligence (IJCAI)*. To appear.
- [21] Diederik P. Kingma and Jimmy Ba. 2014. Adam: A Method for Stochastic Optimization. *CoRR* abs/1412.6980 (2014).
- [22] János Kornai, Eric Maskin, and Gérard Roland. 2003. Understanding the Soft Budget Constraint. *Journal of Economic Literature* 41, 4 (2003), 1095–1136.
- [23] Jean-Jacques Laffont and Jacques Robert. 1996. Optimal auction with financially constrained buyers. *Economics Letters* 52, 2 (1996), 181–186.
- [24] Alexey Malakhov and Rakesh V. Vohra. 2008. Optimal auctions for asymmetrically budget constrained bidders. *Review of Economic Design* 12, 4 (2008), 245.
- [25] Eric S. Maskin. 2000. Auctions, development, and privatization: Efficient auctions with liquidity-constrained buyers. *European Economic Review* 44, 4 (2000), 667–681.
- [26] Roger Myerson. 1981. Optimal Auction Design. *Mathematics of Operations Research* 6 (1981), 58–73.
- [27] Harikrishna Narasimhan, Shivani Agarwal, and David C. Parkes. 2016. Automated Mechanism Design without Money via Machine Learning. In *Proceedings of the 25th International Joint Conference on Artificial Intelligence*. 433–439.
- [28] Harikrishna Narasimhan and David C Parkes. 2016. A general statistical framework for designing strategy-proof assignment mechanisms. In *Proceedings of the Thirty-Second Conference on Uncertainty in Artificial Intelligence*. 527–536.
- [29] Malle M. Pai and Rakesh Vohra. 2014. Optimal auctions with financially constrained buyers. *Journal of Economic Theory* 150 (2014), 383 – 425.
- [30] Tuomas Sandholm and Anton Likhodedov. 2015. Automated Design of Revenue-Maximizing Combinatorial Auctions. *Operations Research* 63, 5 (2015), 1000–1025.
- [31] John von Neumann. 1953. A Certain Zero-sum Two-person Game equivalent to the Optimal Assignment Problem. *Contributions to the Theory of Games (AM-28), Volume II* (1953), 5–12.