Volkswirtschaftliches Seminar
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Wintersemester 2020/2021

MW86 Seminar

Algorithmen: Herausforderung für den Wettbewerb?

Das Seminar beschäftigt sich mit der Bedeutung von Algorithmen für den Wettbewerb auf Märkten. Zahlreiche aktuelle Beiträge von (Wettbewerbs-)behörden (Bundeskartellamt, EU, OECD, usw.) legen nahe, dass (selbstlernende) Algorithmen eine Herausforderung für die Wettbewerbspolitik darstellen. So können Algorithmen Kollusion etablieren—und zwar ohne explizite Absprachen und ohne, dass dies im Code des Algorithmus ersichtlich wäre. Wir schauen uns die Evidenz zum Thema Algorithmen und Wettbewerb an. Neben Seminarthemen zur Programmierung von Algorithmen und verhaltenswissenschaftlichen Aspekten schauen wir uns vor allem Evidenz aus Feldstudien, Experimenten und Simulationen an.

– Themen: Die Seminar- bzw. Vortragsthemen werden in einer Vorbesprechung zu Beginn der Vorlesungszeit vergeben.

– Zielgruppe: Fortgeschrittene Studierende der Studiengänge M.Sc. VWL oder M.Sc. BWL

– Voraussetzungen: MV03 (Mikroökonomik) und MW68 (Spieltheorie) werden empfohlen.

– Prüfungsleistung: Vortrag plus (kurze) Hausarbeit

– Umfang: Zwei dieser Seminare erfüllen zusammen die Anforderungen des Moduls MW86.

0. **Pflichtlektüre für alle:**

- Bundeskartellamt and Autorite de la concurrence (2019). *Algorithms and Competition.* Discussion paper

- Hal Varian (2018). "Artificial intelligence, economics, and industrial organization". In: *NBER Working Paper*

- Kapitel 1 in Richard S Sutton and Andrew G Barto (2018). *Reinforcement Learning: An Introduction.* MIT press

1. **Programmierung von Algorithmen**

1.1. Selbstlernende Algorithmen und Q-Learning am Beispiel von Tic-Tac-Toe

- Richard S Sutton and Andrew G Barto (2018). *Reinforcement Learning: An Introduction.* MIT press; Vor allem Kapitel 1, 3, 4 und 6

- Christopher Watkins and Peter Dayan (1992). "Q-Learning". In: *Machine Learning* 8.3-4, pp. 279–292

- Christopher Watkins (1989). "Learning from Delayed Rewards". In: *Ph.D. Thesis*

2. **Interaktion mit Algorithmen und verhaltenswissenschaftliche Aspekte**

2.1. Algorithmusaversion

- Berkeley J Dietvorst et al. (2015). "Algorithm Aversion: People Erroneously Avoid Algorithms After Seeing Them Err." In: *Journal of Experimental Psychology: General* 144.1, p. 114

- Berkeley J Dietvorst et al. (2018). "Overcoming Algorithm Aversion: People Will Use Imperfect Algorithms If They Can (Even Slightly) Modify Them". In: *Management Science* 64.3, pp. 1155–1170

2.2. Kooperation zwischen Menschen und Algorithmen

- Jacob W Crandall et al. (2018). "Cooperating with Machines". In: *Nature communications* 9.1, pp. 1–12

- Fatimah Ishowo-Oloko et al. (2019). "Behavioural Evidence for a Transparency–Efficiency Tradeoff in Human–Machine Cooperation". In: *Nature Machine Intelligence* 1.11, pp. 517–521

- Christoph March (2019). "The Behavioral Economics of Artificial Intelligence: Lessons from Experiments with Computer Players". In: *CESifo Working Paper*

- Joseph E Harrington (2018). "Developing Competition Law for Collusion by Autonomous Artificial Agents". In: *Journal of Competition Law & Economics* 14.3, pp. 331–363

- Emilio Calvano et al. (2019). "Algorithmic Pricing what Implications for Competition Policy?" In: *Review of Industrial Organization* 55.1, pp. 155–171

- Ariel Ezrachi and M Stucke (2017). "Artificial Intelligence & Collusion: When Computers Inhibit Competition". In: *University of Illinois Law Review* 2017.5

References

Abada, Ibrahim and Xavier Lambin (2020). "Artificial Intelligence: Can Seemingly Collusive Outcomes Be Avoided?" In: *Available at SSRN 3559308.*

Assad, Stephanie, Robert Clark, Daniel Ershov, and Lei Xu (2020). "Algorithmic Pricing and Competition: Empirical Evidence from the German Retail Gasoline Market". In: *CESifo Working Paper.*

Brown, Zach and Alexander MacKay (2019). "Competition in Pricing Algorithms". In: *Available at SSRN 3485024.*

Bundeskartellamt and Autorite de la concurrence (2019). *Algorithms and Competition.* Discussion paper.

Calvano, Emilio, Giacomo Calzolari, Vincenzo Denicolò, and Sergio Pastorello (2019). "Algorithmic Pricing what Implications for Competition Policy?" In: *Review of Industrial Organization* 55.1, pp. 155–171.

— (forthcoming). "Artificial Intelligence, Algorithmic Pricing and Collusion". In: *American Economic Review.*

Cavallo, Alberto (2018). "More Amazon Effects: Online Competition and Pricing Behaviors". In: *NBER Working Paper.*

Chen, Le, Alan Mislove, and Christo Wilson (2016). "An Empirical Analysis of Algorithmic Pricing on Amazon Marketplace". In: *Proceedings of the 25th International Conference on World Wide Web*, pp. 1339–1349.

Crandall, Jacob W, Mayada Oudah, Fatimah Ishowo-Oloko, Sherief Abdallah, Jean-François Bonnefon, Manuel Cebrian, Azim Shariff, Michael A Goodrich, Iyad Rahwan, et al. (2018). "Cooperating with Machines". In: *Nature communications* 9.1, pp. 1–12.

Dietvorst, Berkeley J, Joseph P Simmons, and Cade Massey (2015). "Algorithm Aversion: People Erroneously Avoid Algorithms After Seeing Them Err." In: *Journal of Experimental Psychology: General* 144.1, p. 114.

— (2018). "Overcoming Algorithm Aversion: People Will Use Imperfect Algorithms If They Can (Even Slightly) Modify Them". In: *Management Science* 64.3, pp. 1155–1170.

Ezrachi, Ariel and M Stucke (2017). "Artificial Intelligence & Collusion: When Computers Inhibit Competition". In: *University of Illinois Law Review* 2017.5.

Harrington, Joseph E (2018). "Developing Competition Law for Collusion by Autonomous Artificial Agents". In: *Journal of Competition Law & Economics* 14.3, pp. 331–363.

Ishowo-Oloko, Fatimah, Jean-François Bonnefon, Zakariyah Soroye, Jacob Crandall, Iyad Rahwan, and Talal Rahwan (2019). "Behavioural Evidence for a Transparency–Efficiency Tradeoff in Human–Machine Cooperation". In: *Nature Machine Intelligence* 1.11, pp. 517–521.

Johnson, Justin Pappas, Andrew Rhodes, and Matthij Wildenbeest (2020). "Platform Design when Sellers Use Pricing Algorithms". In: *TSE Working Paper*.

March, Christoph (2019). "The Behavioral Economics of Artificial Intelligence: Lessons from Experiments with Computer Players". In: *CESifo Working Paper*.

Miklós-Thal, Jeanine and Catherine Tucker (2019). "Collusion by Algorithm: Does Better Demand Prediction Facilitate Coordination Between Sellers?" In: *Management Science* 65.4, pp. 1552–1561.

Sutton, Richard S and Andrew G Barto (2018). *Reinforcement Learning: An Introduction*. MIT press.

Varian, Hal (2018). "Artificial intelligence, economics, and industrial organization". In: *NBER Working Paper*.

Watkins, Christopher (1989). "Learning from Delayed Rewards". In: *Ph.D. Thesis*.

Watkins, Christopher and Peter Dayan (1992). "Q-Learning". In: *Machine Learning* 8.3-4, pp. 279–292.