Mustafa Cemil Coşkun

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Interests

My broad interests include *applied probability*, *information theory* and *coding theory*. In particular, I enjoy developing and implementing algorithms for inference in graphical models appearing in communications. In the course of my Ph.D. studies, I focused on the design of polar(-like) codes and their low-complexity decoding. This includes also non-coherent receiver designs for block-fading channels, where my techniques aim at joint channel estimation and decoding of short codes.

Education

Sep. 2017–Present **Ph.D. in Communications Engineering**, *Technical University of Munich (TUM)*, Munich, Germany. Advisor: Prof. Gerhard Kramer.
- Defense planned for early 2022
- Thesis title: "Code analysis and design for successive cancellation list decoders"

Aug. 2019–Jan. 2020 **Visiting Ph.D.**, *Duke University*, Durham, USA. Host: Prof. Henry D. Pfister.
- Efficient (near-)optimum decoding of Reed–Muller and polar(-like) codes over binary-input memoryless symmetric channels and theoretical characterization of the required complexity

Oct. 2014–Feb. 2017 **M.Sc. in Communications Engineering (MSCE)**, *TUM*, Munich, Germany.
- Graduation with high distinction (summa cum laude)
- Focus on coding theory, communication and information theory
- Thesis title: "Successive cancellation decoding of single parity-check product codes"

Sep. 2010–Aug. 2014 **B.Sc. in Electrical and Electronics Engineering**, *Boğaziçi University*, İstanbul, Turkey.
- Graduation with high honor (summa cum laude)
- Focus on control theory

Experience

Mar. 2017–Aug. 2020 **Research Fellow**, *DLR*, Wessling, Germany. Group leader: Dr. Gianluigi Liva.
- Joint project with TUM entitled "Low-latency coding and channel estimation"
- Developing list decoding techniques over fading channels
- Efficient (near-)optimum decoding of product codes with or without an outer code

Apr. 2016–Feb. 2017 **Internship & Master Thesis**, *DLR*, Wessling, Germany. Advisor: Dr. Gianluigi Liva.
- Weight enumerator analysis of short polar codes
- Short codes under ordered-statistics decoding
- Successive cancellation list decoding of single parity-check product codes

Publications

Peer-Reviewed Journal Papers (4 in total)

1 P. Yuan, **M. C. Coşkun**, G. Kramer, "Polar-coded non-coherent communication," *IEEE Commun. Lett.*, vol. 25, no. 6, pp. 1786-1790, Feb. 2021.

2 **M. C. Coşkun**, T. Jerkovits, G. Liva, "Successive Cancellation List Decoding of Product Codes with Reed-Muller Component Codes," *IEEE Commun. Lett.*, vol. 23, no. 11, pp. 1972-1976, Nov. 2019.

3 **M. C. Coşkun**, G. Durisi, T. Jerkovits, G. Liva, William Ryan, B. Stein, F. Steiner, "Efficient error-correcting codes in the short blocklength regime," *Elsevier Phys. Commun.*, vol. 34, pp. 66-79, Jun. 2019.

4 J. Östman, G. Durisi, E. G. Ström, **M. C. Coşkun**, G. Liva, "Short packets over block-memoryless fading channels: Pilot-assisted or noncoherent transmission?," *IEEE Trans. Commun.*, vol. 67, no. 2, pp. 1521-1536, Feb. 2019.

Preprints (3 in total)

1 P. Yuan, **M. C. Coşkun**, "Successive cancellation ordered search decoding of modified $\mathbf{G}_N$-coset codes," *submitted to IEEE Trans. Commun.*, 2021, [Online].

2 **M. C. Coşkun**, H. D. Pfister, "An information-theoretic perspective on successive cancellation list decoding and polar code design," *submitted to IEEE Trans. Inf. Theory (minor revisions)*, 2021, [Online].

3 **M. C. Coşkun**, G. Liva, A. Graell i Amat, M. Lentmaier, H. D. Pfister, "Successive cancellation decoding of single parity-check product codes: Analysis and improved decoding," *submitted to IEEE Trans. Inf. Theory (minor revisions)*, 2020, [Online].

Peer-Reviewed Conference Papers (7 in total)

1 P. Yuan, **M. C. Coşkun**, "Complexity-adaptive maximum-likelihood decoding of modified $\mathbf{G}_N$-coset codes," in *Proc. IEEE ITW*, Oct. 2021.

2 **M. C. Coşkun**, H. D. Pfister, "Bounds on the list size of successive cancellation list decoding," in *Proc. IEEE SPCOM*, Bangalore, India, Jul. 2020.

3 **M. C. Coşkun**, J. Neu, H. D. Pfister, "Successive cancellation inactivation decoding for modified Reed-Muller and eBCH codes," in *Proc. IEEE ISIT*, LA, CA, USA, Jun. 2020.

4 J. Neu, **M. C. Coşkun**, G. Liva, "Ternary quantized polar code decoders: Analysis and design," in *Proc. 53rd Asilomar Conf.*, Pacific Grove, CA, USA, Nov. 2019.

5 M. Xhemrishi, **M. C. Coşkun**, G. Liva, J. Östman, G. Durisi, "List decoding of short codes for communication over unknown fading channels," in *Proc. 53rd Asilomar Conf.*, Pacific Grove, CA, USA, Nov. 2019.

6 **M. C. Coşkun**, G. Liva, J. Östman, G. Durisi, "Low-complexity joint channel estimation and list decoding of short codes," in *Proc. 12th SCC*, Rostock, Germany, Feb. 2019.

7 **M. C. Coşkun**, G. Liva, A. Graell i Amat, M. Lentmaier, "Successive cancellation decoding of single parity-check product codes," in *Proc. IEEE ISIT*, Aachen, Germany, Jun. 2017.

Patents (6 in total)

1 P. Yuan, **M. C. Coşkun**, G. Kramer, "Decoding apparatus and method of decoding," Deutsches Patent- und Markenamt, DE102020128918, Granted, Nov. 2021.

2 **M. C. Coşkun**, T. Jerkovits, "Decoding method," Deutsches Patent- und Markenamt, DE102019200941B4, Granted, Aug. 2020.

3 **M. C. Coşkun**, G. Liva, "Method for encoding and decoding packets in random access protocols," Deutsches Patent- und Markenamt, DE102020101231A1, Filed, Jan. 2020.

4 **M. C. Coşkun**, G. Liva, "Decoding method," Deutsches Patent- und Markenamt, DE102017216264B4, Granted, Sep. 2019.

5 **M. C. Coşkun**, G. Liva, "Process for the transmission of data," Deutsches Patent- und Markenamt, DE102019200483A1, Filed, Jan. 2019.

6 **M. C. Coşkun**, G. Liva, "Decryption method and communication system," Deutsches Patent- und Markenamt, DE102017200075B4, Granted, Jul. 2018.

Teaching

2020, 2021 **Lecturer**, *2-week (75-hour) B.Sc. module "Digital Communications" (EDE3205)*, TUMAsia, Singapore.

2018 – 2021 **Invited Lecturer**, *Seminar on polar codes as a part of M.Sc. module "Channel Codes for Iterative Decoding" (EI7411) (summer semester)*, TUM, Munich, Germany.

2018 **Teaching Assistant**, *Summer school organized for international M.Sc. students on "Redundancy and Irrelevance in Source and Channel Coding" (Prof. Gerhard Kramer and Prof. Bernd Edler)*, Ferienakademie 2018, Sarntal, Italy.

Selected Invited Talks & Tutorials

Nov. 2021 "Polar codes for communication over unknown fading channels," *Short packet transmission for wireless communications*, Paris, France.

Sep. 2021 "Optimum decoding of modified polar codes: From inactivation decoding to tree-search," *Ferienakademie 2021*, Sarntal, Italy.

Jul. 2021 "Polar code design for SCL decoding: An information-theoretic perspective," *2021 Workshop on Coding, Cooperation, and Security in Modern Communication Networks (COCO)*, Munich (Online), Germany.

May 2021 –, *The 35. Meeting of ITG Professional Group Applied Information Theory*, Germany (Online).

Nov. 2020 "Polar codes: Basics and recent advances," *H2020 INCOMING School*, Novi Sad (Online), Serbia.

Jul. 2020 "Average list size of successive cancellation inactivation decoding," *2020 Workshop on Coding, Cooperation, and Security in Modern Communication Networks (COCO)*, Ben-Gurion University (Online), Israel.

Jun. 2020 "List decoding of short codes for communication over unknown fading channels," *Institutskolloquium,* DLR, Wessling, Germany.

Apr. 2019 "Successive cancellation list decoding of certain product codes," *Institutskolloquium,* DLR, Wessling, Germany.

Mar. 2019 "Successive cancellation decoding of single parity-check product codes: Analysis and improved decoding algorithms," *The 33. Meeting of ITG Professional Group Applied Information Theory*, Ulm, Germany.

Graduate Coursework

The first number in parentheses is the actual grade provided in the German grading scale and the second one is a conversion using the Bavarian Formula.

- Channel Codes for Iterative Decoding $(1.0 \approx 4.00)$
- Coded Modulation $(1.0 \approx 4.00)$
- Communications Lab $(1.3 \approx 3.80)$
- Image and Video Compression $(1.3 \approx 3.80)$
- Information Theory $(1.7 \approx 3.53)$
- MIMO Systems $(1.2 \approx 3.87)$
- Multi-User Information Theory $(1.7 \approx 3.53)$
- Seminar on Topics in Commun. Eng. $(1.0 \approx 4.00)$
- System-on-Chip Technologies $(1.3 \approx 3.80)$
- Time-Varying Sys. and Computations $(1.3 \approx 3.80)$

Supervised Students

M.Sc. Theses (5 in total)

2019 Marvin Xhemrishi (TUM) – "Polar codes for pilot-assisted transmission" (joined TUM as a Ph.D. candidate).

2018 Joachim Neu (TUM) – "Quantized polar code decoders: Analysis and design" (with Dr. Gianluigi Liva and joined Stanford as a Ph.D. candidate).

M.Sc. Research Internships (5 in total)

2021 Anmoal Porwal (TUM) – "Inactivation decoding of single parity-check product codes" (started M.Sc. thesis at TUM).

2018 Marvin Xhemrishi (TUM) – Polar codes for pilot-assisted transmission (started M.Sc. thesis at TUM).

B.Sc. Theses (3 in total)

2020 Z. Asena Kırık (BOUN) – "Investigation of error-correcting codes over the binary erasure channel" (with Prof. Ali E. Pusane & joined U of T as a graduate student).

Selected Professional Service

2018–Present Reviewer for *IEEE Commun. Lett.* (21 papers), *IEEE Trans. Commun.* (13 papers), *IEEE Wireless Commun. Lett.* (5 papers), *IEEE Trans. Wireless Commun.* (3 papers), *IEEE Trans. Signal Process.* (1 paper), *IEEE Trans. Inf. Theory* (1 paper).

2017–Present Reviewer for several *IEEE* conferences and workshops including (but not limited to) ISIT, ITW, GLOBECOM, WCNC & ICC.

Jul. 2018 Co-organizer of "TUM-COM Workshop on Ultra-Reliable Low-Latency Communications (URLLC) and Applications for 5G".

Computer Skills

Julia, Matlab, C, C++, SageMath.

Languages

Turkish **Native**

English **Fluent**

German **Intermediate**

References

Prof. Gerhard Kramer (TUM), gerhard.kramer@tum.de

Dr. Gianluigi Liva (DLR), gianluigi.liva@dlr.de

Prof. Henry D. Pfister (Duke), henry.pfister@duke.edu