

# MEHDI SALEHIFAR

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## Education

**Ph.D. (Doctor of Philosophy) in Electrical Engineering** .....Sep. 2012 – July 2017

[Communication and Signal Processing]

*University of California Santa Barbara (UCSB)*

*Thesis: Common Information and Hidden State Dependencies in Layered Source Coding*

**Master of Science in Electrical Engineering** .....Sep. 2012 – July 2014

[Communication and Signal Processing]

*University of California Santa Barbara (UCSB)*

**Bachelor of Science in Electrical Engineering** .....Sep. 2008 – July 2012

[Telecommunication Minor in Abstract Mathematics]

*University of Tehran, Iran*

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## Working Experience

**Senior Research and Standard Engineer** .....July 2017 – Present

*LG Electronics (Mobile Research Lab), USA*

- Research and developing new technology for next generation video coding standard (VVC)
- Designed new secondary transform, with 5.44% gain on top of VTM, meanwhile reduced the multiplication and memory complexity; outperforming all other available transforms on gain and complexity.
- Designed new NSST index coding based on scanning the residual data and implicitly coding it (with 0.5% and 0.31% gain on top of the VTM and BMS respectively).
- Designed new primary transform (DST7, DCT8) based on DFT implementation, reducing number of the multiplication. Also reduced the number of the AMT candidate, which yields to 12% encoding time reduction with no loss.
- Deigned new MVD coding for Affine prediction, based on dividing to layers, and sublayer, with 0.1% gain on top of the BMS.
- Designed new Intra prediction mode coding using table-based non-MPM coding, as well as adaptive MPM list building (the first part has 0.1% gain on top of the JEM, second part under more experiment).
- Researching and developing new algorithm for residual coding.
- Actively researching and initiating new ideas and giving future directions to the team
- Supervise and help the teammates with their implementations and result analysis.

## Working Experience

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**Interim Engineering Intern** .....Sep. 2016 – Dec. 2016  
Qualcomm Incorporated, USA

- Developed and evaluated new algorithms for stereo/multi-channel scalable audio coding and implemented them in next generation audio coder
- Got expert with aptX and got acquainted with CELT, AAC, and G719

**Multimedia Research Intern** .....June 2016 – Sep. 2016  
LG Electronics (Mobile Research Lab), USA

- Developed new tools for inter prediction video coding and implemented in HEVC

**Graduate Research Assistant** .....Sep. 2012 – July 2017  
Department of Electrical Eng., UC Santa Barbara, CA

- Exploit common information in layered coding and designing optimum coding scheme for audio signal
- Designed and optimized encoding and decoding system for scalable and individual coding of Hidden Markov Sources

**Undergraduate Researcher** .....April 2011- Aug. 2012  
Department of Electrical Eng., Tehran University, Tehran, Iran

- Used fractional Fourier transform in cognitive radio for OFDM's PAPR reduction
- Used Cyclotomic fields and Galois extensions for approximating unit before DSP Processor

## Patent

1. **M. Salehifar**, M. Koo, S. Kim, J. Lim, "Apparatus on Reduced Transform for Video Coding", US Provisional Application Number 62/599,020.
2. **M. Salehifar**, S. Kim, "Apparatus on Mode Decision Based on Machine Learning", US Provisional Application Number 62/651,233.
3. **M. Salehifar**, S. Kim, M. Koo, J. Lim, "Apparatus on Non-Separable Transform Kernels", US Provisional Application Number 62/679,940.
4. **M. Salehifar**, S. Kim, "Adaptive Intra Prediction Most Probable Mode Coding", US Provisional Application Number 62/668,188.
5. **M. Salehifar**, S. Kim, "Apparatus on Non-MPM Intra Prediction Mode Coding", US Provisional Application Number 62/651,680.
6. **M. Salehifar**, M. Koo, S. Kim, J. Lim, "Adaptive Multiple Transform Index Coding Based on Intra Prediction Mode", US Provisional Application Number 62/681,631.
7. S. Kim, **M. Salehifar**, M. Koo, J. Lim, "Unified Transform Indicator", US Provisional Application Number 62/651,238.
8. **M. Salehifar**, S. Kim, "Apparatus on Methodized of Scanning Pattern for Patterned Data", US Provisional Application Number 62/599,024.
9. **M. Salehifar**, S. Paluri, S. Kim "Methods and Apparatus on Affine MVD Coding Based on Layer Coding", US Provisional Application Number 62/693,387.

## Patent

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10. **M. Salehifar**, S. Kim, "Apparatus on Generalized Residual Coding with NSST Index", US Provisional Application Number 62/599,022.
11. **M. Salehifar**, S. Kim, "Apparatus on Post Processing of Video Coding with Machine Learning", US Provisional Application Number 62/651,235.
12. **M. Salehifar**, S. Kim, J. Lim "Apparatus on Adaptive Secondary Transform Indicator Coding", US Provisional Application Number 62/599,021.
13. **M. Salehifar**, S. Paluri, S. Kim "Apparatus on Selective Transform", US Provisional Application Number 62/609,270.
14. **M. Salehifar**, M. Koo, S. Kim, J. Lim, "Methods And Apparatus On Reduced Secondary Transform Coding Structure Based On Memory Reduction Kernel Mapping", US Provisional Application Number 62/693,397.
15. **M. Salehifar**, M. Koo, S. Kim, J. Lim, "Reduced Adaptive Multiple Transform", US Provisional Application Number 62/679,939.
16. **M. Salehifar**, S. Kim, "Apparatus on Context Modeling for Intra Prediction Most Probable Mode Coding", US Provisional Application Number 62/668,182.
17. M. Koo, **M. Salehifar**, S. Kim, J. Lim, "Methods And Apparatus of Layered Givens Transform Design", US Provisional Application Number 62/692,893.
18. M. Koo, **M. Salehifar**, S. Kim, J. Lim, "Methods and Apparatus of Primary Transform Design Using Discrete Fourier Transform", US Provisional Application Number 62/692,888.
19. M. Koo, **M. Salehifar**, S. Kim, J. Lim, "Low Complexity Discrete Sine Transform Type 7 Design Using Discrete Fourier Transform", US Provisional Application Number 62/685,224.
20. M. Koo, **M. Salehifar**, S. Kim, J. Lim, Methods and Apparatus for Approximation of Primary Transform", US Provisional Application Number 62/658,607.
21. M. Koo, **M. Salehifar**, S. Kim, J. Lim, "Methods and Apparatus for Transform Type Decision", US Provisional Application Number 62/662,227.
22. M. Koo, **M. Salehifar**, S. Kim, J. Lim, "Methods and Apparatus for Secondary Transform of Partitioned Block", US Provisional Application Number 62/651,236.
23. M. Koo, **M. Salehifar**, S. Kim, J. Lim, "Methods and Apparatus for Reduction of Rotation Based Transform", US Provisional Application Number 62/651,246.

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## Peer Review

*Over 20 journal and conference papers for:*

IEEE Transaction on Multimedia (**TMM**)

IEEE International Symposium on Information Theory (**ISIT**)

IEEE International Conference on Image Processing (**ICIP**)

## Contribution To Standard

1. **M. Salehifar**, M. Koo, J. Lim, S. Kim, "Reduced Secondary Transform (RST)," Joint Video Expert Team (JVET) of ITU-T SG 16 WP 3 and ISO/IEC JTC1/SC 29/WG 11, 11th meeting, Ljubljana, SI, 10-18 July 2018.
2. **M. Salehifar**, M. Koo, J. Lim, S. Kim, "Matrix Multiplication Based NSST with Reduced Memory Map," Joint Video Expert Team (JVET) of ITU-T SG 16 WP 3 and ISO/IEC JTC1/SC 29/WG 11, 11th meeting, Ljubljana, SI, 10-18 July 2018.
3. M. Koo, **M. Salehifar**, J. Lim, S. Kim, "AMT Replacement and Restriction," Joint Video Expert Team (JVET) of ITU-T SG 16 WP 3 and ISO/IEC JTC1/SC 29/WG 11, 11th meeting, Ljubljana, SI, 10-18 July 2018.
4. S. Paluri, **M. Salehifar**, S. Kim, "Vector Coding of Affine MVD," Joint Video Expert Team (JVET) of ITU-T SG 16 WP 3 and ISO/IEC JTC1/SC 29/WG 11, 11th meeting, Ljubljana, SI, 10-18 July 2018.
5. **M. Salehifar**, et al., "Description of SDR Video Coding Technology Proposed by LG Electronics," Joint Video Expert Team (JVET) of ITU-T SG 16 WP 3 and ISO/IEC JTC1/SC 29/WG 11 JVET-J0017, 10th meeting, San Diego, CA, 10-20 April 2018.
6. M. Koo, **M. Salehifar**, J. Lim, S. Kim, "Layered Givens Transform," Joint Video Expert Team (JVET) of ITU-T SG 16 WP 3 and ISO/IEC JTC1/SC 29/WG 11, 11th meeting, Ljubljana, SI, 10-18 July 2018.

## Publication

1. **M. Salehifar**, T. Nanjundaswamy, and K. Rose, "Layered Coding of Hidden Markov Sources," to be submitted to IEEE Transaction on Signal Processing.
2. **M. Salehifar**, T. Nanjundaswamy, and K. Rose, "On Quantizer Design to Exploit Common Information in Layered Coding of Vector Sources," to be submitted to IEEE Transaction on Signal Processing.
3. **M. Salehifar**, T. Nanjundaswamy, and K. Rose, "Joint Design of Layered Coding Quantizers to Extract and Exploit Common Information", IEEE Data Compression Conference, March 2016.
4. **M. Salehifar**, T. Nanjundaswamy, and K. Rose, "Quantizer Design for Exploiting Common Information in Layered Coding", International Conference on Acoustics, Speech and Signal Processing (ICASSP), March 2016.
5. **M. Salehifar**, T. Nanjundaswamy, and K. Rose, "On Scalable Coding of Hidden Markov Sources," International Conference on Acoustics, Speech and Signal Processing (ICASSP), March 2016.
6. **M. Salehifar**, E. Akyol, K. Viswanatha, and K. Rose, "On Optimal Coding of Hidden Markov Sources," IEEE Data Compression Conference, March 2014.

## Award

**Full Assistantship** from UC Santa Barbara for Masters and Ph.D. Program .....2012-2017

International Mathematical Competition: **Honor of Mention** .....2012

Iranian National Mathematics Competition: **Gold Medal** .....2012

Iranian National Mathematics Competition: **Bronze Medal** .....2011

**Four Year Scholarship** from Iranian National Elite Organization .....2008-2012

Iranian University Entrance Exam: **Top 0.01 percent** among 350,000 Participants .....2008

Iranian Mathematics Olympiad: **Silver Medal** .....2007

Iranian High School Chess Competition: **Gold Medal** .....2005

## Teaching Experience

**Graduate Teaching Assistant** .....Sep. 2012–Mar. 2017  
*Department of Electrical Eng., UCSB, CA*

- Signal Analysis-ECE 130B *Winter 2017*
- Probability and Statistics-ECE 139 *Spring 2013*
- Communication Systems-ECE 146A *Winter 2013*
- Circuit, Devices, and System-ECE 2A *Fall 2012*
- Grader: Pattern Recognition, Information Theory, Signal Compression

**Undergraduate Teaching Assistant** .....Sep. 2010–Sep. 2012  
*Department of Electrical Eng., and Mathematics, Tehran University, Tehran, Iran*

- Digital Signal Processing, Combinatorics for Tehran University's Mathematics Team
- Calculus I

**Mathematic Instructor for High School** .....Sep. 2008–Sep. 2010

## Computer Skill

**Programming Language:** Proficiency in C++ and MATLAB, familiar with Python, R, Assembly

**Video Codec:** HM, JEM, VTM, BMS (HEVC and VVC video codec)

**Engineering Languages:** Hspice, Pspice, Quartus, Modelsim, Proteous, Codevision, PSCAD, PSAT, Simulink

## Course Work

Multirate Digital Signal Processing • Signal Compression • Advanced Digital Signal Processing • Digital Communication Theory • Information Theory • Error Correcting Code • Pattern Recognition • Stochastic Process in Engineering • Matrix Analysis Game Theory