GEDU501: Scientific Writing **POSLEC**

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Results + Discussion + Conclusion Reading Worksheet

Identifying Moves in Your Reading

Instructions

1. *Insert information from one research article you read in the **Article Information** table.*
2. *Using the Results, Discussion and Conclusion sections from one of the research articles you are reading, copy and paste 1~2 example sentences that perform the move described in the **Reading Table.***
3. *If the information is not available put N/A (N/A or not applicable) in the example space. I.e. if "we" or "our" is not used in the sections you are reading, you can place N/A in that example space in the table.*

Article Information

Title	A Model-Driven Deep Learning Method for Normalized Min-Sum LDPC Decoding
Author (s)	Qing Wang; Shunfu Wang; Haoyu Fang; Leian Chen; Luyong Chen; Yuzhang Guo
Journal Title	2020 IEEE International Conference on Communications Workshops (ICC Workshops)
Year of Publishing	07-11 June 2020
Volume/Issue	
Pages	p.6
Keywords / Search Terms	Model-driven, deep learning, Min-Sum, LDPC, decoding

Results Reading Table

Results	
Structure	Answer
Underline or Highlight how section is organized	Results
Reason for this structure	'Result section' was used to analyze result obtained through tensorflow(experiment), and Analysis was performed accordingly, so 'discussion section' was not separately set, but its function is included.
Moves	Example from your article
Review of experimental procedure	Paper) we train and test the proposed NNMS and SNNMS LDPC decoding networks using Tensorflow framework. The first experiment tests the system robustness. The system robustness can be measured using BER performance with respect to the quality of the training data. The second experiment analyzes the BER performance in terms of the number of network layers. (Third) We compare the performance of the proposed SNNMS decoding network with NNMS and CNMS. The computational complexity is listed in table I, where T is the number of iterations. - researcher use Tensorflow framework. And researcher experimented 3 things : robustness, number of layers, complexity.
Description of analysis style used	Paper) we train and test the proposed NNMS and SNNMS LDPC decoding networks using Tensorflow framework. - Superiority of proposed method was compared by measuring the Bit Error Rate(BER) value through tensorflow and then comparing performance with each other. In case of complexity, it was compared through FLOPs.
Referencing tables, charts or figures	TABLE I COMPLEXITY COMPARISON OF LDPC DECODERS Item / CNMS / NNMS / SNNMS CMP: $\sum_{j=1}^{N-k} n_j(a_j-2)T$ / $\sum_{j=1}^{N-k} n_j(a_j-2)T$ / $\sum_{j=1}^{N-k} a_j(a_j-2)T$ XOR: $\sum_{j=1}^{N-k} n_j(a_j-2)T$ / $\sum_{j=1}^{N-k} n_j(a_j-2)T$ / $\sum_{j=1}^{N-k} a_j(a_j-2)T$ ADD: $\sum_{i=1}^{N} b_i(b_i-1)T+1)T$ / $\sum_{i=1}^{N} b_i(b_i-1)+1)T$ / $\sum_{i=1}^{N} b_i(b_i-1)+1)T$ MUL: T / $\sum_{j=1}^{N-k} n_j(a_j-2)T+\sum_{i=1}^{N} b_i(b_i-2)T$ / $2T$ Paper) The computational complexity is listed in table I, where T is the number of iterations.
Describing visual trends in tables, charts or figures	Paper) The computational complexity is listed in table I, where T is the number of iterations. We can find that the SNNMS decoder has lower complexity compared with the NNMS. (CNMS : Conventional Normalized Min-Sum)
Emphasizing unexpected, surprising or interesting results	Paper) We can find that the SNNMS decoder has lower complexity compared with the NNMS. & SNNMS decoding network is closer to the original LDPC code structure in model mechanism, so it has better performance in model-driven deep learning method. - In other words, researcher show that performance has results as similar to prior method as possible, even though complexity is improved(reduced) compared to prior method.
Grammatical Features	Example from your article
Passive (수동태)	low-density parity-check (LDPC) code was first proposed by Gallager in 1962 [1] and has been one of the research hotspots in the field of channel coding and decoding technology due to its high decoding throughput [2] [3] [4] and the bit error rate (BER) performance approaching Shannon capacity limit
Reason for use	Since 'Gallager'(researcher) announced LDPC, so 'passive use' is correct.

Active (능동태)	Comparing with the BP decoding method, the MS decoding method significantly reduces the computation and hardware complexity at a cost of performance degradation.
Reason for use	MS decoding solved complexity problem, because method was to reduce amount of computation.
Additional features	Example from your article
Underline or Highlight tense used most	Past tense
Citation and Reference to other papers	The LDPC code is designed according to IEEE 802.16e standard with code block length 576 and rate 3/4, where the codeword is selected randomly and the parity check matrix H is from [22].

Discussion + Conclusion Reading Table

Structure	Answer
How section is organized *(can copy from above section if combined)*	**only conclusion section**
Reason for this structure	Because research is a simulation research rather than theoretical.
Moves	Example from your article
Summary of key results / research goal or problem	Paper) Researcher firstly propose a NNMS, SNNMS LDPC decoding network. In NNMS, it optimized correction factor, and In SNNMS, it improved complexity by sharing factor. Nevertheless, the performance was similar to the prior one. - researcher proposed NNMS by applying neural network to improve performance, and SNNMS to improve complexity.
Claims / generalizations / interpretations of results	Paper) In addition, the improved SNNMS decoder is acceptable for long codes application thank to the lower latency and less computational complexity, which is durable in practice.
Intext referencing equation, tables, charts or figures	Paper) Simulation results shows the proposed SNNMS decoder can achieve better BER performance with lower computation complexity compared with the NNMS decoder. - Using the corresponding method to compare performance through the simulation result from the tensor flow.
How their results/findings (prior research) compare to other studies	Paper) x - Since proposed method is first time, prior paper was not referenced, but results of other research were used to compare performance.
Limitations	x
Implications of their research on the research field /area	Paper) In this paper, we firstly propose a NNMS LDPC decoding network based on a model-driven deep learning network, by unfolding the LDPC decoding algorithm into neural network and training the learnable correction factors. - it is first time, a neural network was applied to NMS. So, "N" is added to the NMS, so it's called “NNMS”.
Possible applications for their research	Paper) X - Complexity improvement allows application to HardWare(HW) such as semiconductors.
Suggestions or recommendations for future research	Paper) In the future work, we plan to design a fixed-point decoder and accelerate the neural network on FPGA.
Grammatical Features	Example from your article & explanation
Modal verb (조동사)	x
Reason for use	x
Passive (수동태)	By sharing the correction factors, the SNNMS LDPC decoding network is proposed to reduce the complexity.
Reason for use	Because a new method(SNNMS) was introduced.
Active (능동태)	Simulation results shows the proposed SNNMS decoder can achieve better BER performance with lower computation complexity compared with the NNMS decoder.
Reason for use	To summary simulation results, researcher use ‘show’.
Additional features	Example from your article
Underline or Highlight tense used most (가장 많이 사용되는 시제)	Present tense
Use of I / my or We / our	In this paper, we firstly propose a NNMS LDPC decoding network based on a model-driven deep learning network, by unfolding the LDPC decoding algorithm into neural network and training the learnable correction factors.

Paper has too short conclusion section as follow :

VI. Conclusions

In this paper, we firstly propose a NNMS LDPC decoding network based on a model-driven deep learning network, by unfolding the LDPC decoding algorithm into neural network and training the learnable correction factors. By sharing the correction factors, the SNNMS LDPC decoding network is proposed to reduce the complexity. Simulation results shows the proposed SNNMS decoder can achieve better BER performance with lower computation complexity compared with the NNMS decoder. In addition, the improved SNNMS decoder is acceptable for long codes application thank to the lower latency and less computational complexity, which is durable in practice. In the future work, we plan to design a fixed-point decoder and accelerate the neural network on FPGA.