Name: kimheeseo Date: 2022.11.22

**Results + Discussion + Conclusion Reading Worksheet**

Identifying Moves in Your Reading

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| 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.*

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| *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 |

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| Results Reading Table |

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| **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 | 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. |
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| 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]. |

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| Discussion + Conclusion Reading Table |

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| 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 :

