Your Introduction Outline

Practicing Moves in Your Research Writing

Instructions

1. Fill in the outline notes in the space to the right **ABOUT YOUR RESEARCH** (NOT a paper you read), based on the questions to the left
    a. DON'T forget to erase the examples before putting your notes in
2. **Do NOT write** full **paragraphs** in the notes sections below

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Moves	Specific Qs	Notes
Broad: Topic Background	What is the overall topic?	Improved performance of 'Min-Sum' decoding based on deep learning architecture 'LSTM'
	Why is this topic important / interesting?	● Deep-learning application : Deep learning has recently shown remarkable achievements in various fields, so I applied it to my research field. ● Since one of deep learning architecture called, 'RNN' similar to 'LSTM' have shown remarkable performance in previous paper [1], So I think 'LSTM' will be able to perform well better than previous paper.
Specific: Prior research knowledge: papers you have read	What are/are one or two major ideas that are similar in prior research?	● Use of existing deep learning architecture on channel coding. ● Focus on decoding performance improvement.
	What is a pattern or trend found in the papers?	● Adjust existing deep learning architectures such as CNN and RNN to fit the communication field. [1] : RNN, [5] : CNN [2] : first applied deep learning on channel coding [3] : applied deep learning on normalized min-sum, offset min-sum(NMS, OMS : kind of decoding method.) ● Reduce iteration or amount of calculation. - It is a common goal of research applying deep learning. So almost paper has this result.
	What information from these papers is useful to your research? Why?	● Weighted Belief Propagation : [2] ● Why? 'Nachmani' is first researcher who applied deep learning to channel coding for improving performance but reducing complexity.

메모 포함**[c1]:** Add citation

		• Correction factor, Shared Neural NMS : [3] • Why? It shows that correction factor used in the existing(conventional) decoding methods, normalized Min-Sum (NMS) and offset Min-Sum (OMS), can be optimized through deep learning.
	What are some limitations of these studies? What is some unexpected or surprising info/results from the papers? (i.e. the gap)	• [2] : limitation of study was that many multiplication equations were used as different weights were allocated to edge. So, calculation complexity increased. Therefore, there is a limitation that it is difficult to apply to long-length codes. • Surprising results : since it was first paper to apply deep learning, direction for future research applying it was presented. • Using deep learning, the performance is similar to conventional decoding process(Belief Propagation algorithm), and the number of iteration is reduced.
More specific: About your Research	What is the specific problem your research is focusing on?	• Other deep learning architecture - My idea focuses on deep learning architecture 'lstm' application and is used to determine whether it is possible in channel coding field by overcoming disadvantages of applying 'RNN' to research in other existing fields such as translation by applying lstm. • using 'relaxation'(combination of prior and current data for high quality performance)
	What is the goal / purpose of your research	• Improved performance I think performance is more important than complexity.
	What is the specific scope / are the boundaries of your research?	• [4] : Model scope of using only 'lstm' among deep learning architectures. • My lab are studying LDPC (low density parity check code) among the codes used in various decoding (e.g. BCH code, polar code), so proposed method(my idea) is intended to be applied only to LDPC.
	Shortly, what type of experimentation will you perform to accomplish your goal?	• Just simulation : In the case of channel coding (field of communication), experiments are not conducted using experimental(Hardware) equipment directly. • For experiment, we evaluate performance (simulation) of proposed method using Matlab or Python's programming language and deep learning framework.

메모 포함[c2]: Which ones, be specific.

	If (when) your experiment is complete, how do (will) your outcomes affect future researchers in your field (and or everyday people)?	- Since it has been less than five years since deep learning has been used in the channel coding field, there are many areas where deep learning has not been applied. So, it will be possible to determine whether deep learning can be applied in this area. - Through simulation performance and limitations, plan for future research.

[1] E. Nachmani, E. Marciano, D. Burshtein, and Y. Beʹery, ʺRNN decoding of linear block codes,ʺ arXiv preprint arXiv:1702.07560, 2017.

[2] E. Nachmani, Y. Beʹery, and D. Burshtein, ʺLearning to decode linear codes using deep learning,ʺ in Proc. IEEE Annu. Allerton Conf. Commun. Control Comput. (Allerton), Monticello, IL, USA, 2016, pp. 341–346.

[3] Q. Wang, S. Wang, H. Fang, L. Chen, L. Chen, and Y. Guo, ʺA model-driven deep learning method for normalized min-sum LDPC decoding,ʺ in Proc. IEEE Int. Conf. Commun. Workshops (ICC Workshops), Dublin, Ireland, 2020, pp. 1–6.

[4] Sak, H., Senior, A., & Beaufays, F. (2014). Long short-term memory recurrent neural network architectures for large scale acoustic modeling. Fifteenth Annual Conference of the International Speech Communication Association.

[5] F. Liang, C. Shen, and F. Wu, "An iterative BP-CNN architecture for channel decoding," IEEE J. Sel. Topics Signal Process., vol. 12, no. 1, pp. 144–159, Feb. 2018.