Paper:IoT-0455-2015 Low weight code comparison for electromagnetic wireless nanocommunication
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Editor: Dr. IoNT Special Issue

Dear editor, dear reviewers,
We would like to thank both reviewers for their help. Below you will find our answers to their reviews. We are open to any further remarks.

COMMENTS FOR THE AUTHOR:

Reviewer: 1

Comments to the Author

Overall, this paper appears to me to be very superficial with little information regarding the specifics of the nano channel. The authors have taken many top level equations and simply compared them against each other. Critically though, I cannot see an uncoded channel or link though so could not say if coding is a benefit or not in the first place. For example, energy efficiency, whilst important is not the same as absolute energy, so an efficient scheme which needs lots of energy still needs lots of energy which may not be available at the nano.
We have added some text about it in section IIIA (Metrics), more specifically about required energy for transmitting data in nanonetworks, and that coding is a low-energy consuming process. We also added Uncoded method in each figure.
Essentially, this is an unfocused overview at a high level. Many of the ideas presented are not well conceived. It is an internet of nano things so it is an collection of ultra ultra low power simple devices, not sending images between them but bits or tens or bits. Images being sent are more like a conventional internet of things issue. I also don't know why this discussion of MATLAB exists as MATLAB is not going to be running on a nano-machine either.
About sending bits or tens of bits: We added a sentence in Introduction: "Note that, even if nanodevices are small, data size exchanged among them can be very big, as is the case for nano-camera, and medical or wireless network-on-chip applications for example." and also in the beginning of Numerical results section.
About MATLAB: MATLAB is not and will not be used in a nanomachine. We used it to compute results, such as bandwidth expansion and number of bits 1 generated. MATLAB is also used in several papers references, such as "Minimum Energy Channel Codes for Nanoscale Wireless Communications" (IEEE Tr. on Wireless Communications), reference which has been added to our article, as asked by reviewer 2, and also for methods LWC and MTE. We also removed information about hardware and software running MATLAB.
It would have been better to focus on fewer codes and explain how or if they can be actually be implemented at the nano or in fact if the equations are correct at the nano. You have for example managed to take the work of work Jonet in [14] and shortened it to 15 lines and then followed it with 5 lines about Huffman with no information on how to implement it (if it can be). This paper either needs to be a review paper with full sources, or a technical paper with more information, but it cannot be both.
We removed Huffman code, which is not really related to nanocommunication, and, as per reviewer 2's remark, we added MEC code.
We also added a sentence in section IIIA about the fact that codes in this paper just map input bits to output bits, hence a simple process, as stated by various references.

Also:

1. All the full names of the abbreviations should be given on first occurrence.
We think everything is fine now.
2. Equation (1) gives three conditions for different i, but two of them seems overlap with each other, the author should be justified how to use them or it doesn't matter.
This is fixed (we replaced m by m+2).
3. Reference [15] appears early than reference [14].
This is fixed.
4. The parameter 'a' appeared many times for different meanings. These should be revised.

This is fixed, in LWC method presentation we replaced a by w. We also replaced a by b_E in bandwidth expansion.
5. Equation (24) and (25) should be explained future. The author denoted that Npulse is the number of transmitted pulse but I think it is more like the sum of all the pulses.
We improved the explanation.
6. This paper consider about the nanocommunication based on an electromagnetic channel, I think there should include something about the electromagnetic channel, for me it looks like some comparisons between different codes, but no related with the electromagnetic channel, like how special between this channel with other traditional communication channels.
We have added two new metrics, information rate and codeword error rate, which use electromagnetic channel properties, so specific to nanocommunication.
7. The author should give the method about how to calculate the computational complexity to give the Fig 8. What kind of encoding and decoding methods is better for the system you proposed. In my opinion, section E in page 7 should be improved by giving more details.
We computed the execution time of execution through MATLAB. However, given that execution on nanodevices is not the same as in MATLAB on a computer, and that we added PER (Packet Error Rate) measures as asked by the second reviewer, we decided to simply remove the section about computational complexity.

8. It is better if the authors can give the PSNR formula directly rather than give a reference [18] without the specific page. And the author gave numerical results for 'robustness against transmission errors', is it possible to give theoretical results? If not, why
We added PSNR formula in section III.F.
We added BER and CER (as asked by reviewer 2) in section III.F (explanation) and in section IV.F (theoretical results, robustness). As data in theoretical result is general data, and not an image, PSNR does not apply; we added a sentence about that in section IV.F.

Reviewer: 2

Comments to the Author
In this paper, the authors compare different low-weight coding strategies for electromagnetic nanonetworks. More specifically, first, the authors introduce 7 existing source coding techniques and propose a new technique, which is a straightforward variation of one of the techniques. Then, they compare these techniques using different metrics, including energy efficiency, bandwidth expansion, impact on multi-user interference, robustness against transmission errors and computational complexity. The analysis is first done theoretically and, then, the performance of the different coding strategies is analyzed for the transmission of an image of a single cancer cell. This makes the results very relevant.

The topic is timely and very well aligned with this special issue. Data transmission in wireless nanosensor networks is still at its infancy, but studies like this can help the development of the field.

In terms of quality of presentation, the paper is overall acceptable, but needs some improvements in terms of writing. Please see me detailed comments below:

However, there are several issues that need to be addressed before I can recommend this paper for publication. Without following any particular order:

1) For completeness, the authors need to incorporate the minimum weight codes described in:
M. Kocaoglu and O. B. Akan, "Minimum energy channel codes for nanoscale wireless communications," IEEE Transactions on Wireless Communications, vol. 12, no. 4, pp. 1492–1500, 2013.
Such codes exhibit the minimum weight possible, at the cost of very large bandwidth expansion. It would be beneficial to incorporate them in the comparison.
Thank you for the reference. We have added it along with the other codes (presentation, figures, comparison etc.)
2) In Sec. III.F, the authors discuss the robustness against transmission errors offered by the different channel coding schemes, but they mainly focus on the Peak Signal to Noise Ratio (PSNR). However, it would be

more relevant to talk about Bit Error Rate (BER), Block Error Rate (BLER) or perhaps Packet Error Rate (PER) even. The main justification for such study is that, while indeed, different coding strategies might result in lower PSNR and, thus, lower BERs, the transmission of longer codewords can result into equal or even higher BLER and PER. In other words, what is the point in reducing the BER if then there are more bits transmitted and the final BLER is the same. Such discussion and evaluation is missing in the paper.
We have added two new metrics, BER and CER, and used them throughout all the paper. CER is the same as BLER and PER. And indeed NPG exhibits the property you wrote: it has the lowest BER, but is worse in CER (due to large codeword size); we emphasized this idea in the paper.
3) Sec. II.F, P(1) should be defined as w/m, not over n. I hope this was just a typo, otherwise all the results need to be revised.
This is fixed, thank you. We just mispelled n as m.
4) What is the binary stream used in Sec. IV? More details on the type of data that is transmitted in that case is needed.
We added this information in the second paragraph of sec. IV.
5) In terms of structure, I suggest the following changes:
- The introduction needs to have a clear description of the contributions of the paper. It also should give more emphasis to the fact that part of the results are obtained when transmitting a cancer cell image.
We expanded the paragraph about the contributions (in Introduction) and specified that a cancer file is also used for results.
- The first paragraph in Section II can be removed, as it is practically the same as in the Introduction.
Indeed, we removed it, thank you.
- I perhaps would suggest merging section III and section IV into a single section. As it is now, it seems very repetitive and confusing to some extent. For example, there are some results for the energy efficiency given in Sec. III.A, and some others given in Sec. IV. A. What is the difference? That is not clear to me.
After careful thinking, we decided to still keep the two sections separated. Metrics section is for presenting metrics, and next sections IV and V are for presenting results (theoretical in IV and numerical with a file in V).
6) Regarding quality of presentation, there are several typos/grammatical errors that need to be fixed, for example,
- In the abstract:
— “Time Spread-On Off Keying” -> “Time-spread On-Off Keying”
This is fixed.
— “performs quite well” -> Too informal, inaccurate. The authors need to provide a more accurate statement about the performance of their proposed coding scheme.
This is fixed.
- In the introduction:
— “total dimension between” -> “total dimensions between” -> In fact, nanosensors have dimensions of cubic nanometers or micrometers.
We replaced with size.
— Throughout the paper, whenever “i.e.” or “e.g.” are used, these need to be preceded and followed by comma.
We fixed them. Note that it depends if it is American or British English.
— “a pulse spread in time” -> It seems to me that the pulses are not spread in time, but their transmissions are.
For simplicity, we removed "spread in time".
— Throughout the paper, make sure that all the abbreviations and acronyms are defined the first time (only) and then used consistently. For example, right now, ME, NME, PG, etc., are all used in the introduction, but not defined till Section II. Please fix this.
We think everything is fine now.
I would suggest the authors to carefully proof-read the entire manuscript before resubmitting it.
We did it, and hope it is fine now.
- Regarding the references, [9] seems to be redundant.
We removed it from the Introduction, but it is still used in multi-user interference section.