From: **Pooya Ashtari** pooya.ash@gmail.com
Subject: Next Steps for Our Manuscript (Quantization-free Lossy Image Compression Using Integer Matrix Factorization)
Date: 6 January 2025 at 08:03
To: pourya.behmandpoor@esat.kuleuven.be, Fateme Nateghi Haredasht fnateghi@stanford.edu, Jonathan H Chen jonc101@stanford.edu, Panos Patrinos panos.patrinos@esat.kuleuven.be, Sabine Van Huffel Sabine.VanHuffel@esat.kuleuven.be

Dear Coauthors,

Happy New Year! I hope you all had wonderful holidays and are feeling refreshed for the year ahead.

As you know, our TIP manuscript was unfortunately rejected. While this is certainly disappointing, what's more frustrating is the nature of the reviews we received. After nearly five months of waiting, many of the comments were either nonscientific, incorrect, or missed the core contributions of our work. Specifically, the reviewers seem to have overlooked the novelty and effectiveness of our integer matrix factorization (IMF) methodology and its application to low-bitrate image compression. It's clear that some reviewers either didn't fully read the method section or didn't understand it due to the lack of familiarity with optimization and low-rank approximation techniques.

Reviewer 2's assertion that IMF is misaligned with the Human Vision System (HVS) is simply not a relevant criticism, and their claim that IMF lacks novelty because "matrix factorization is widely used" ignores the uniqueness of our approach, particularly the introduction of integrality constraints and our efficient coordinate descent algorithm.

Reviewer 3's comments were even more puzzling. Describing our substitution of DCT and quantization as "unreasonable" and our method "not convincing" while disregarding the clear experimental evidence in favor of IMF over JPEG at low bitrates feels more like a dismissal than constructive criticism.

That said, we are confident in the quality and novelty of our work, and we shouldn't dwell too much on these comments. The strengths of our work remain clear, and our results speak for themselves. The plan is to make a few minor revisions and resubmit to another journal as soon as possible. Together with Pouyra, we've identified the following potential target journals, listed in order of priority:

1. IEEE Transactions on Multimedia (IF: 8.4, h-index: 152, Q1)
2. Information Sciences (IF: 7.9, h-index: 227, Q1)
3. Expert Systems with Applications (IF: 7.5, h-index: 271, Q1)
4. Applied Soft Computing (IF: 7.2, h-index: 191, Q1)

Please let me know your thoughts on these options or if you have additional suggestions.

I'll share the revised manuscript shortly so we can move forward swiftly.

Looking forward to hearing your feedback!

Best,
Pooya

---------- Forwarded message ---------
From: **Transactions on Image Processing** <onbehalfof@manuscriptcentral.com>
Date: Wed, Dec 18, 2024 at 10:53 AM
Subject: Decision to REJECT - TIP-33053-2024, Quantization-free Lossy Image Compression Using Integer Matrix Factorization
To: <pooya.ashtari@esat.kuleuven.be>
Cc: <zzchen@ieee.org>, <zzchen@whu.edu.cn>, <benoit.macq@uclouvain.be>, <patricia.focant@uclouvain.be>, <m.langdon@ieee.org>, <ezgli@i2r.a-star.edu.sg>, <pooya.ashtari@esat.kuleuven.be>

18-Dec-2024

Dr. Pooya Ashtari
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Manuscript: TIP-33053-2024, "Quantization-free Lossy Image Compression Using Integer Matrix Factorization".

Dear Dr. Pooya Ashtari,

I am writing to you concerning the above referenced manuscript, which you submitted to the IEEE Transactions on Image Processing (T-IP).

The authors proposed an Integer Matrix Factorization (IMF) based lossy image compression method. The idea is interesting. However, the reviewers have the major concerns on the contributions in image compression. The experiments are not sufficient

However, the reviewers have the major concerns on the contributions in image compression. The experiments are not sufficient to demonstrate the advantages of the proposed method. Based on the enclosed set of reviews, I regret to inform you that your manuscript has been rejected for publication.

Please note that according to IEEE Signal Processing Society policy "Handling of Rejected Papers" (http://signalprocessingsociety.org/volunteers/policy-and-procedures-manual), the Society prohibits resubmission of rejected manuscripts more than once. Authors should carefully review the aforementioned policy before resubmitting their manuscript.

If you have any questions regarding the reviews, please contact me. Any other inquiries should be directed to Mikaela Langdon.

Thank you for submitting your work to the IEEE Transactions on Image Processing. We hope you consider us again in the future.

Sincerely,

Dr. Zhenzhong Chen
Associate Editor
IEEE Transactions on Image Processing
zzchen@ieee.org, zzchen@whu.edu.cn

Mikaela Langdon
Coordinator Society Publications
IEEE Signal Processing Society
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Reviewer Comments:

Reviewer: 1

Recommendation: RQ - Review Again After Major Changes

Comments:
This paper introduces an integer matrix factorization (IMF)-based approach to develop a novel quantization-free lossy image compression method. Specifically, it first represents the image data as a product of two smaller factor matrices with bounded integer elements to eliminate the need for quantization. The authors propose an efficient, provably convergent iterative algorithm for IMF using a block coordinate descent (BCD) scheme. Simulations on the Kodak and CLIC 2024 datasets demonstrate that our IMF compression method consistently outperforms JPEG at low bit rates below 0.25 bits per pixel (bpp), remains comparable at higher bit rates, and improved top-1 accuracy by over 5 percentage points compared to JPEG at bit rates under 0.25 bpp.

Overall, this paper is well-organized and easy to understand. The idea behind the approach is simple but seems effective for low-bitrate image coding. However, the explanations and discussion for better performance (compared to JPEG and SVD) approaches under low-bitrate settings are insufficient. There are three main concerns:
1. the proposed approach applies low-rank approximation and round operations (which can also be regarded as quantization), which could have a negative effect on the image and coding performance. Why such operations are better than existing approaches with quantization?
2.Also, why does the proposed algorithm only achieve better performance on low-bitrate image coding settings as compared to JPEG? Is it related to the entropy model (as JPEG did not use the zlib)? The authors had better make fair comparisons with JPEG using the same entropy model.
3. Finally, the authors should test the proposed approach's performance on recent image coding schemes (like BPG) to see whether it works for more advanced schemes.

Other comments:
1. Is there any evidence for the description "SVD is more sensitive to quantization errors compared to transform-based methods like JPEG, especially at low bit rate"
~~2. Are there any assumptions or conditions that low-rank approximations can work? How can the approximation be dealt with if it cannot work under any settings?~~
~~3. What is the performance (quality and runtime) of the proposed approach on a high-resolution image? The authors should illustrate it.~~

Additional Questions:
1. Is the topic appropriate for publication in these transactions?: Adequate Match

1. Is the paper technically sound?: Yes

2. How would you rate the technical novelty of the paper?: Novel Enough for Publication

Explain: This paper introduces a variant of integer matrix factorization (IMF) to develop a novel quantization-free lossy image compression method. Specifically, it first represents the image data as a product of two smaller factor matrices with bounded integer elements, thereby eliminating the need for quantization. The authors propos an efficient, provably convergent iterative algorithm for IMF using a block coordinate descent (BCD) scheme. Simulations on the Kodak and CLIC 2024 datasets demonstrate that our IMF compression method consistently outperforms JPEG at low bit rates below 0.25 bits per pixel (bpp) and remains comparable at higher bit rates, and improved top-1 accuracy by over 5 percentage points compared to JPEG at bit rates under 0.25 bpp.

3. Is the contribution significant?: Incremental

4. Is the coverage of the topic sufficiently comprehensive and balanced?: Yes

5. Rate the Bibliography: Satisfactory

1. How would you rate the overall organization of the paper?: Satisfactory

2. Are the title and abstract satisfactory?: Yes

3. Is the length of the paper appropriate? If not, recommend what should be added or eliminated.: Yes

4. Are symbols, terms, and concepts adequately defined?: Yes

5. How do you rate the English usage?: Satisfactory

If you are suggesting additional references they must be entered in the text box provided. All suggestions must include full bibliographic information plus a DOI.
: N/A

Reviewer: 2

Recommendation: R - Reject

Comments:
This paper presents a lossy image compression method using Integer Matrix Factorization (IMF). The image in RGB format is converted to YUV420 domain and then patched into 8x8 blocks. Each component of the flatten blocks are factorized to two smaller integer matrices using IMF and at the decoder side the image can be reconstructed by matrix multiplication. From the experimental results, this method shows some effectiveness compared to JPEG at the low bitrate and the advantage of decoding speed due to its simple operation on decoder side.

~~But considering that human vision system (HVS) is more sensitive to Low-frequency information but less sensitive to high-frequency part which is the basis of modern transform-quantization based image/video compression.~~ While the matrix factorization will not take the HVS into consideration, hard to predict whether the lost information is important. The operation of factorization is highly related to the resolution and target bitrate. The complexity on the encoder side is unacceptable if we want to maintain good quality for a high-resolution picture. Accordingly, I think this method is not appropriate for practical image compression applications.

Besides, How to control the bitrate? I guess the bitrate and quality is related with the rank R, but how to choose the suitable R for images with different resolution is not clear.

Additional Questions:
1. Is the topic appropriate for publication in these transactions?: Adequate Match

1. Is the paper technically sound?: Yes

2. How would you rate the technical novelty of the paper?: Not Novel

Explain: Using matrix factorization in data compression is widely used before and IMF is not appropriate for image compression area.

3. Is the contribution significant?: Incremental

4. Is the coverage of the topic sufficiently comprehensive and balanced?:

5. Rate the Bibliography: Satisfactory

1. How would you rate the overall organization of the paper?: Satisfactory

2. Are the title and abstract satisfactory?: Yes

3. Is the length of the paper appropriate? If not, recommend what should be added or eliminated.: Yes

4. Are symbols, terms, and concepts adequately defined?: Yes

5. How do you rate the English usage?: Satisfactory

If you are suggesting additional references they must be entered in the text box provided. All suggestions must include full bibliographic information plus a DOI.
: /

Reviewer: 3

Recommendation: R - Reject

Comments:
This paper presents an interesting attempt to use Integer Matrix Factorization to replace transform coding and quantization

This paper presents an interesting attempt to use Integer Matrix Factorization to replace transform coding and quantization. Unfortunately, it does not meet TIP's requirements from the perspectives of motivation, method design, discussion, and experimental results. Detailed reasons are present as follows:
1. From the beginning, the title is misleading. As a core operation in compression, quantization is significant and is a broad concept. We can use a codebook to achieve vector quantization and rounding operations to achieve discrete quantization. In this paper, the Integer Matrix Factorization is obviously an implicit quantization operation to determine the remaining information iteratively. Therefore, "Quantization-free" is not appropriate to be used.
~~2. This paper has almost no relationship with Learned Image Compression, so there is no need to describe it in the related work chapter.~~
~~3. JPEG was released in 1992, and the proposed methods cannot even have superior performance on all bitrates. Besides, the encoding computing cost is significantly higher than JPEG due to the iterative strategy. In other words, the proposed method has neither a performance nor a speed advantage over JPEG.~~
~~4. Many references need to be modified due to the incomplete description.~~

Additional Questions:
1. Is the topic appropriate for publication in these transactions?: Adequate Match

1. Is the paper technically sound?: No

2. How would you rate the technical novelty of the paper?: Not Novel

Explain: The authors propose an interesting attempt to use Integer Matrix Factorization (IMF) to replace transform coding and quantization. However, the unreasonable substitution of DCT and quantization is not convincing, and the experimental results can also prove it.
The authors emphasized that they are the first effort to explore IMF for image compression, the attempt may be new, but not novel.

3. Is the contribution significant?: Not Significant

4. Is the coverage of the topic sufficiently comprehensive and balanced?: Treatment somewhat unbalanced, but not seriously so

5. Rate the Bibliography: Unsatisfactory

1. How would you rate the overall organization of the paper?: Could be improved

2. Are the title and abstract satisfactory?: No

3. Is the length of the paper appropriate? If not, recommend what should be added or eliminated.: Yes

4. Are symbols, terms, and concepts adequately defined?: Not always

5. How do you rate the English usage?: Satisfactory

If you are suggesting additional references they must be entered in the text box provided. All suggestions must include full bibliographic information plus a DOI.
: None.