分からない人に分かりやすく説明する。

踏み込んだ内容や本質から外れた内容の話はしない方がいい。誰も付いて来れなくなる。

P1

I’d like to thank you for giving me the chance to speak here today.

DCTとICAの基底を用いたハイブリット手法について発表します。

I will present the hybrid method using DCT and ICA basis.

P2：目次

今日の発表はこのような流れです。

this is what I will be presentation today.

First, I’ll introduce DCT and ICA.

Then, I’ll explain the problem of the Hybrid method and the prior method of that.

Followed by explain my proposed method and experimental results.

Lastly, I’ll conclude with a summary.

P3：

私が研究している画像符号化は、画像を効率よく伝送・保存するために、情報を圧縮する技術です。

Image coding, which I am studying, is a technology for compressing information in order to transmit and preserve images efficiently.

右の画像は人が知覚しづらい情報を削減しているため、見た目が同じでも情報量は1/8まで減っている。基底関数を用いた符号化法としてDCTが良く知られている。

The image on the right has the same appearance as the image on the left, but the entropy has been reduced to 1/8. DCT is well known as image coding method using basis.

P4：DCTの説明

DCTは、ブロック内の画素を周波数成分に変換した時、大部分の係数が低周波に集中する。

In DCT, when the pixels in a block are converted into frequency components, most of the coefficients are concentrated at low frequencies.

また、人の眼は模様のような高周波には対応できないという特性を持っているため、人の眼が対応できる低周波の情報をあまり減らさず、高周波の情報を多く削っている。

Also, because the human eye has the characteristic of not being able to respond to high frequencies such as patterns, we do not remove much of the low frequency information that the human eye can respond to, and remove much of the high frequency information.

これにより、肌や背景などの平坦な特徴の保存に有効である。しかし、低符号化レートでは、模様などの情報を削りすぎてしまい、視覚的な歪みが発生してしまう。

This makes it effective in preserving flat features such as skin and background, but at low bit rates, it removes too much information such as patterns, resulting in visual distortion.

P5：ICAの説明

一方で、ICAは、DCTと同じように基底とその係数値により画像を保存することができます。

On the other hand, ICA can preserve images by basis and its coefficient values, just like DCT.

また、ICAは画像中の主要な特徴を基底とするため、伝送相手との共有が必須である。

In addition, the basis of ICA is unique to the input image and must be shared with the transmission partner.

ICAは局所的な特徴をDCTよりも少ない個数の基底で保存できる。

ICA can preserve local features in a smaller number of bases than DCT.

しかし、DCTが得意とする平坦な特徴はDCTよりも多くの基底を使わないと保存ができない。

However, the flat features that DCT is good at cannot be preserved without using more basis than DCT.

P6：ハイブリッド手法の検討

すなわち、DCTとICAでは符号化において、得意とするブロックが一枚の画像中で異なることが分かる。

Summarizing the previous explanations, we can see that DCT and ICA have different blocks that they are good at in a single image.

そのため、DCTでは保存が困難であった特徴をICAによって保存することで、入力画像の特徴を効率的に保存することを可能とする、ハイブリット型符号化法が提案されている。

Therefore, a hybrid type coding method has been proposed, in which the features of the input image can be efficiently preserved by ICA, which is difficult to preserve by DCT.

P7：従来手法の課題

ここで、ICA基底は画像に固有であるため、共有する必要があることを思い出してほしい。

Recall here that the ICA basis is specific to the image, and therefore needs to be shared.

高い画質を得るためには、多くの基底を用いたほうが良いが、共有する情報量が増えてしまうため、符号化性能が劣化してしまう。

In order to obtain high image quality, it is better to use a large number of bases, but the entropy to be shared increases, which degrades the coding performance.

そのため、ハイブリット手法の目標は、ICA基底の数が制限されても、符号化性能を向上できる基底とブロックを特定すること。

The goal of the hybrid method is to identify the bases and blocks that can improve the coding performance even when the type of ICA basis is limited.

P8：ハイブリット手法のイメージ

次に、ハイブリット手法のイメージを説明します。

Next, I will explain the image of the hybrid method.

これは、同じ画質で保存した時の情報量を表しています．

This shows the entropy that can be preserved at the same image quality.

ICAはDCTよりもエントロピーを少なくできますが、付加情報を加えた場合、DCTよりもエントロピーが多くなります。

ICA has less entropy than DCT, but when additional information is added, it has more entropy than DCT.

（この付加情報は基底の種類に比例して多くなります．）

(This additional information increases in proportion to the type of basis.)

そこで、step1のようにDCTとICAが得意な領域に分類することで、DCT単独よりもエントロピーを減らすことができます。

Here, by classifying the data into regions where DCT and ICA are good at, as in step 1, we can reduce the entropy more than DCT alone.

しかし、付加情報により、DCTよりもエントロピーが多くなります。

However, the additional information will increase the entropy more than DCT.

そこで、step2のように、使用する基底を重要な基底のみに制限することで、付加情報を加えた場合でも、DCT単独からエントロピーを減らすことができます。

Therefore, by restricting the basis used to only the important basis as in step2, we can reduce the entropy from DCT alone even when additional information is added.

P9：

次に、提案手法の目標を説明します。

Next, we explain the goal of the proposed method.

従来手法のStep1では、ICAの量子化法に改善の余地があると考えました。

In Step 1 of the conventional method, we considered that there was room for improvement in the ICA quantization method.

また、Step2では、重要なICA基底の評価方法に改善の余地があると考えました。

Also, in Step 2, we considered that there is room for improvement in the evaluation method of the important ICA basis.

そのため、提案手法はこれらの問題を解決することで、従来手法の符号化性能の向上を目指します。

Therefore, the proposed method aims to improve the coding performance of the conventional method by solving these problems.

P10：

これはシステム構成です。

This is the system diagram of proposed method.

画像を入力し、step1でICAにおける量子化の優先順位を決定します。

Input an image and determine the quantization priority in ICA in step1.

Step1をもとに、DCTとICAが得意なブロックに分類します。

Based on step1, we classify the image into blocks that are good at DCT and ICA.

そして、各ICA基底を評価し、重要なICA基底を決定します。

Then, each ICA base is evaluated to determine the important ICA bases.

最後に、最終的なDCTブロックとICAブロックを決定し、重要なICA基底は付加情報となります。

Finally, the final DCT and ICA blocks are determined, and the important ICA bases becomes the additional information.

これにより、DCTとICAの得意なブロックに分類することができるため、画像をより効率的に保存することができる。

This allows us to classify the image into blocks that are good at DCT and ICA, thus allowing us to store the image more efficiently.

P11：

まず初めに、Step1の量子化に用いられる優先度の決定です。

The first step is to determine the priority to be used for quantization in Step 1.

ブロックを再構成するとき、複数個の基底を組み合わせることが多いため、量子化後の基底同士の組み合わせは最適なものでなければなりません。

Since we often combine multiple bases when reconstructing a block, the combination of the ICA bases after quantization must be optimal.

しかし、従来手法ではそれが考えられていませんでした。

However, this has not been considered in conventional methods.

そのため、基底の組み合わせを考えた優先度を提案する。

Therefore, we propose a priority that considers the combination of the ICA basis.

例えば、このブロックの3番目に優先度が低い基底を決定するとき、それよりも優先度の低い基底と同時に使用した時に、最も画質を高くできる基底を3番目に量子化の優先度が低い基底を決定する。

For example, the third lowest priority basis in this block is the basis that can produce the highest image quality when used with all the ICA bases with lower priorities than this.

4番目以降も同じように決定する。

The fourth and subsequent priority are determined in the same way.

これにより、すべての優先度においてICA基底の組み合わせを考えられているため、量子化した時の画質は最適になる。

This ensures that the combination of ICA bases is considered for all priorities, so that the image quality when quantized is optimal.

P12：

Step2は各基底の評価と重要な基底の選出です。

Step 2 is to evaluate each ICA basis and select the important ICA basis.

このスライドでは、各基底の評価法を説明します。

In this slide, we will explain how to evaluate each basis.

左の図は、この3つの基底を使用した時に、画質を最適にできるブロックを赤、画質を最適にはではないがDCTから画質を向上できるブロックを青で示している。

The figure on the left shows in red the blocks that can optimize image quality when using these three bases, and in blue the blocks that do not optimize image quality but can improve image quality from DCT.

従来手法では、赤のブロックしか使用していなかったため、右の緑色のグラフほどしか画質が改善しなかった。

In the conventional method, only the red blocks were used, so the image quality was improved only to the value shown in the green graph on the right.

性能の向上においては、赤のブロック以外にも青のブロックも存在している。

In the improvement of image quality, there are also blue blocks in addition to red blocks.

そのため、提案手法では青と赤のブロックを各基底の評価に用いる。

Therefore, in the proposed method, blue and red blocks are used for the evaluation of each basis.

これにより、右のオレンジのグラフのように各基底が改善可能な画質が向上し、本来の有効性を評価することができる。

This allows us to evaluate the intrinsic effectiveness of each basis, as shown by the orange graph on the right.

P13：

次に、重要な基底を選出するための手法の説明です。

Next is a description of the method used to select the important ICA basis.

左はDCT単独のエントロピー、真ん中はこれらの基底が最適または準最適なブロックのエントロピーを表しています。

On the left is the entropy of DCT only, and in the middle is the entropy of the blocks for which these ICA bases are optimal or sub-optimal.

ICA基底のエントロピーを加えた場合でもDCT単独のエントロピーを超えず、ICA基底の中で、最も画質が高くなるものを重要な基底として選出します。

The most important basis is the one that does not exceed the entropy of the DCT only even when the entropy of the ICA bases is added, and has the highest image quality.

そのため、付加情報を考えても符号化性能を改善可能である、最適な基底を選ぶことができる。

Therefore, it is possible to select the most suitable basis, which can improve the coding performance even when additional information is considered.

P14：

提案手法を画増“Airplane”に適用させたときの符号化性能を比較しています。

また、レートごとにICA\_Blockが異なるため、レートごとに提案手法を適用させています。

This section compares the coding performance of the proposed method when it is applied to the "Airplane" image increase.

横軸はエントロピー、縦軸は画質を表していて、左上にあるほど性能が良いことを表しています。

Since ICA\_Block is different for each rate, we apply the proposed method to each rate.

The horizontal axis represents entropy and the vertical axis represents image quality.

グラフを見ると、提案手法はDCT単独や従来手法から符号化性能が改善していることが分かります。

Comparing the entropy to preserve the same image quality, we can see that the proposed method improves the coding performance since it has less entropy than DCT only or the conventional method.

また、低レートであるほど有効であることも分かります。

We can also see that it is more effective at lower bit rates.

P15：

次に、提案手法を適用させたときの符号化レートごとのICA\_Blockと選出された重要なICA基底を示しています。

Next, we show the ICA\_Blocks and the selected important ICA basis for each bit rate when the proposed method is applied.

提案手法はICA基底を最大3個までと制限しており、中レートでも基底を選出可能であることが分かります。

It can be seen that the proposed method limits the number of ICA basis to a maximum of three, which means that the basis can be elected even at medium rates.

従来手法では、25dB以下の超低レートで1、2個しか選出できていなかったため、大きな改善であると言えます。

This is a significant improvement over the conventional method, which can only select one or two bases at very low bit rates below 25 dB.

三枚の画像を比較すると、ICAは低レートの方が効果的であることが分かります

Comparing the three images, we can see that ICA is more effective at low bit rates

また、ICA\_Blockは視覚的に平坦なブロックに多いため、入力画像に性能が依存していることも考えられます。

Also, since ICA\_Blocks are mostly found in visually flat blocks, it is possible that the performance depends on the input image.

P16：

最後に、高レートにおける符号化性能と主観評価の結果です。

Finally, we show the coding performance at high bit rates and the subjective evaluation results.

提案手法を画像”Airplnae”に適用させたときの符号化性能とICA\_Blockを表示しています。

We show the coding performance and ICA\_Block of the proposed method applied to the image "Airplnae".

約50dBの高レートでも符号化性能を改善できていることが分かります。

It can be seen that the encoding performance is improved even at a high bit rate of near 50 dB.

また、視覚的な評価では、提案手法はDCTよりも画像の局所的な特徴を保存できていることが分かります。

The visual evaluation also shows that the proposed method preserves the local features of the image better than DCT.

P17：

結果に対する考察です。

Next is a discussion of the results.

準最適なブロックを調査しているときに、平均値だけでも画質を向上させることのできるブロックを発見しました。

While investigating quasi-optimal blocks, we found some blocks that can improve the image quality even with only average values.

提案手法が高レートでも符号化性能を改善可能である要因の一つだと考えています。

We believe that this is one of the factors that make the proposed method capable of improving the coding performance even at high rates.

最後に、今後の展開です。

Finally, we would like to discuss our future work.

提案手法はレートごとに処理を分ける必要があるため、処理コストの削減を行います。

Since the proposed method requires separate processing for each bit rate, we will reduce the processing cost.

P18：

以上で発表を終わります。

This concludes my presentation.

ご清聴ありがとうございました。

I am not good at English, but thank you for listening to my presentation until the end.

質疑応答例

・質問が良く聞こえなかったとき

Sorry, I didn’t catch all of that. Could you repeat your question, please?

・質問の意図が分からなかったとき

I’m afraid I don’t understand.　Could you please rephrase the question?

・質問を確かめるとき（一部分からないとき）

Are you asking about 〇〇? Could you be more specific?

・感謝を伝えるとき

That’s a great question. 　Thank you for asking.

・もう少し調査が必要な時

We need to do more studies to answer this.

・答えが分からないとき

I’m sorry. I’m afraid I don’t know the answer to that question.

・どのスライドを指している？

Which slides are you referring to?

・Yesで答えられるとき

Yes, that's it.　Sure it is.　I'm sure you are right.　Yes, it is possible.　That’s right.

・Noで答えられるとき

That's not what I meant.

Unfortunately, I cannot agree with your idea, because ...

・もう一度説明するとき

I am sorry. I think my original explanation was too confusing. Let me try to explain that again.

・指摘ありがとうございます

Thank you for making a good point.

・答えになっているといいな

Does that answer your question?

質問例

・ICA\_Blockは異なるため、レートごとに処理を分ける必要があります。

　そのため、処理コストの削減を今後の目標としています。

Since ICA\_Block is different, it is necessary to separate the processing for each rate.

Therefore, our future work is to reduce processing costs.

・処理コストが多くなるため、提案手法では重要基底を最大で3個までとしている

　また、現状の方法ではどの画像も最大で3個までしか重要な基底を使用できていない。

　今後、使用できる重要な基底の数が増える可能性があるため、手法を検討している。

Due to the high processing cost, the proposed method limits the number of important bases to a maximum of three.

Also, with the current method, only about 3 important bases can be used in any image.

Since the number of important ICA bases that can be used may increase in the future, we are considering a method.

・

P1

　I’d like to thank you for giving me the chance to speak here today.

I will present the hybrid method using DCT and ICA basis.

P2

this is what I’ll be presentation today.

First, I’ll introduce DCT and ICA.

Then, I’ll explain the problem of conventional method and propose of hybrid method.

Followed by explain my proposed method and experimental(イクスぺリメンタル) results.

Finally, I’ll conclude(コンクルード) with a summary.

P3

Image coding, which I‘ｍ studying, is a technology for compressing information in order to transmit(トランスミット) and preserve images efficiently(エフィシェントリー).

The image on the right has the same appearance(アピアランス) as the image on the left, but the entropy has been reduced to 1/8.

DCT is well known as image coding method using basis.

P4

In DCT, when the pixels in a block are converted(コンバーティッド) into frequency components, most of the coefficients are concentrated(コンセントレーティッド) at low frequencies.

Also, because the human eye has the characteristic of not being able to respond to high frequencies such as patterns, we do not remove much of the low frequency information that the human eye can respond to, and remove much of the high frequency information.

This makes it effective in preserving flat features such as skin and background, but at low bit rates, it removes too much information such as patterns, resulting(リザルティング) in visual distortion.

P5

On the other hand, ICA can preserve images by basis and its coefficient(コエフィシェント) values, just like DCT.

ICA basis is inherent to the input image and must be shared with the transmission(トランスミッション) partner.

also, quantization of ICA is by restricting(リストリクティング) the basis used for preserve.

Therefore, ICA can preserve local features in a smaller number of bases than DCT.

However, the flat features that DCT is good at cannot be preserved without using more basis than DCT.

P6

As mentioned before, we can see that DCT and ICA have different blocks that they are good at in a single image.

Therefore, hybrid coding method has been proposed, in which the features of the input image can be efficiently preserved(プリザーブ) by ICA, which is difficult(ディフィカルト) to preserve by DCT.

P7

To use DCT and ICA together, the area of ​​the input image must be segmented into DCT\_Blocks or ICA\_Blocks.

Then, by comparing(コンピアリング) with DCT, we identify(アイデニファイ) the blocks that ICA is good at.

Also, recall that ICA basis is inherent to the input image.

When considering(コンシダリング) additional information, it‘s necessary to restrict the number of ICA bases used in the entire image.

The goal of the hybrid method is to identify the bases and blocks that can improve the coding performance even when the type of ICA basis is restricted.

P8

Next, I’ll explain the image of the hybrid method.

This shows the entropy that can be preserved at the same image quality.

ICA has less entropy than DCT, but when additional information is added, it has more entropy than DCT.

(This additional information increases in proportion(プロポーション) to the type of basis.)

Here, by segmenting into areas where DCT or ICA is good at, as in step 1, the entropy of the coefficient only can be reduced more than DCT only.

However, since the number of bases used in the entire image is free, the total entropy will increase more than DCT.

Therefore, by choosing the basis used to only the important basis as in step2, the total entropy will decrease more than DCT.

P9

Next, I’ll explain the goal of the proposed method.

In Step 1, we propose a method to improve the quantization of ICA.

Also, In Step 2, we propose improve of the method of assessing(アセッシング) important ICA bases.

Therefore, the proposed method purpose(パーパス) to improve the coding performance by using the above methods.

P10

This is the system diagram of proposed method.

Step1 propose a method to maximize the image quality of ICA at any bit rate in the input image.

Based on step1, segment the input image into blocks that are good at DCT or ICA.

Then, each ICA base is assessed(アセース) to choose the important ICA bases.

Finally, the proper(プロピアー) DCT\_blocks and ICA\_blocks are determined, and the important ICA bases becomes the additional information.

This allows us to choose the image into blocks that are good at DCT and ICA, thus(ザス) allowing us to preserve the image more efficiently(エフィシェントリ).

P11

ICA quantization is done by restricting the bases.

In order to quantize, we need to determine the number and types of bases needed to preserve the block.

In practice, the number of ICA bases is determined when the bit rate is specified(スペシフィード).

Therefore, we need to determine what types of bases to use.

For example, if the basis determines which the number of basis 2.

When combined with the 1st optimal basis that minimizes(ミニマイズ) MSE is determined as the optimal combination.   
By repeating(リピーティング) this process even if there are 3rd or more bases, the optimum combination is determined.

P12

In this slide, I’ll explain how to assess each basis.

The figure on the left shows in red the blocks that can optimize image quality when using these 3 bases, and in blue the blocks that do not optimize image quality but can improve image quality from DCT.

In the case of only the red blocks were used, so the image quality was improved only to the value shown in the green graph on the right.

In the improvement of image quality, there are also blue blocks in addition to red blocks.

Therefore, in the proposed method, blue and red blocks are used for the assess of each basis.

This allows us to assess the intrinsic(イントリンス) effectiveness(エフェクティブネス) of each basis, as shown by the orange graph on the right.

「アニメーしょん」

This is the same when combining different types of ICA basis.

P13

Next is a description(ディスクリプション) of the method used to choose the important ICA basis.

On the left is the entropy of DCT only, and in the middle is the entropy of the blocks for which these(ジーズ) ICA bases are optimal or semi-optimal.

The orange circle in the figure on the right points to the important basis of the proposed method.

In the proposed method, the important basis is that the image quality is improve and the entropy is reduce.

Of those(ゾース), choose the basis that gives the highest image quality.

Therefore, the number of bases can be restricted(リストリクト) in the entire(エンタイアー) image and the coding performance can be improved.

P14

In this slide, I’ll explain the coding performance of the proposed method when it’s applied(アプライド) to the "Airplane" image .

Since ICA\_Block is different for each bit rate, we apply the proposed method to each bit rate.

The horizontal(ホライゾンタル) axis of this graph represents(リプレセンツ) entropy and the vertical(バーティカル) axis represents(リプリゼンツ) image quality.

Comparing(コンペアリング) the entropy to preserve the same image quality, we can see that the proposed method improves the coding performance since it has less entropy than DCT only or the conventional method.

We can also see that it ‘s more effective at lower bit rates.

P15

Next, I’ll explain the ICA\_Blocks and the choosed important ICA basis for each bit rate when the proposed method is applied.

Looking at the slides, we can see that the proposed method restrict the number of ICA basis to a maximum of 3.

This means that the basis can be chose even at medium rates.

This result is a significant(シグニフィケント) improvement over the conventional method, which can only choose １ or ２ bases at very low bit rates below 25 dB(デシボー).

Comparing(コンペアリング) the 3 images, we can see that ICA is more effective at low bit rates.

Also, since ICA\_Blocks are mostly found in visually flat blocks, it ‘s possible that the performance depends(デペンズ) on the input image.

P16

Finally, I’ll explain the coding performance at high bit rates and the visual evaluation results.

The graph show the coding performance and ICA\_Block of the proposed method applied to the image "Airplnae".

We can see from the graph that the coding performance is improved even at a high bit rate of near 50 dB.

The visual evaluation also shows that the proposed method preserves(プリザーブ) the local features of the image better than DCT.

P17

Next is a discussion(ディスカッション) of the results.

While researching for a semi-optimal basis, found the blocks that can improve image quality even with only average values.

We think that this is one of the factors that make the proposed method capable(ケパボー) of improving the coding performance even at high rates.

Finally, is our future work.

Since the proposed method needs separate(セパレーツ) processing for each bit rate, we will reduce the processing cost.

P18

This concludes(コンクルード) my presentation.

I am not good at English, but thank you for listening to my presentation until the end.

Thank you for your attention.