JPEG

# JPEG strategy on AI and Multimedia

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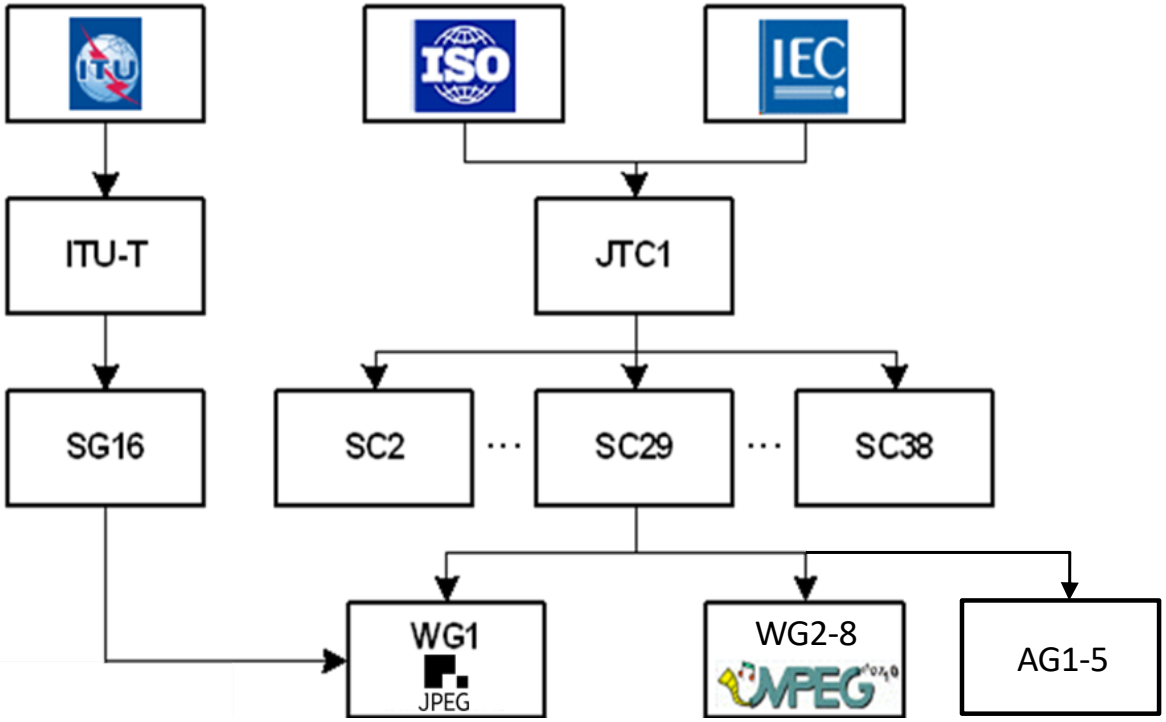
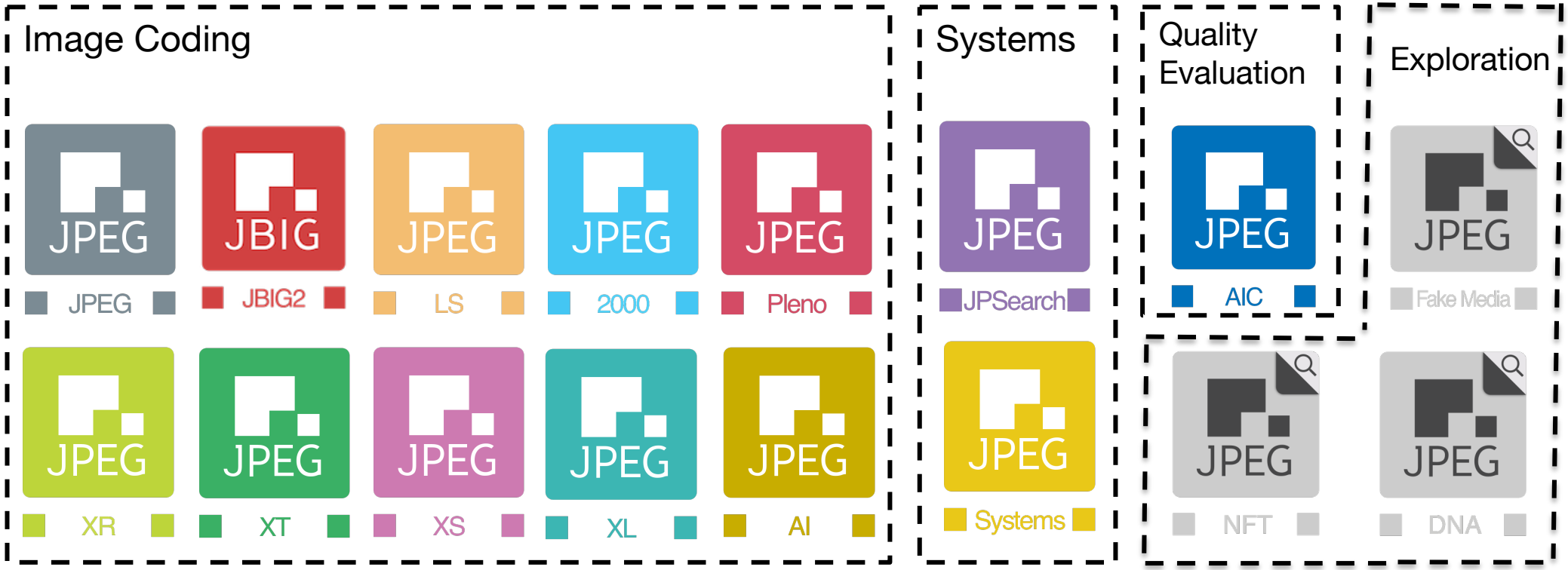
**JPEG Convenor**

# What is JPEG?

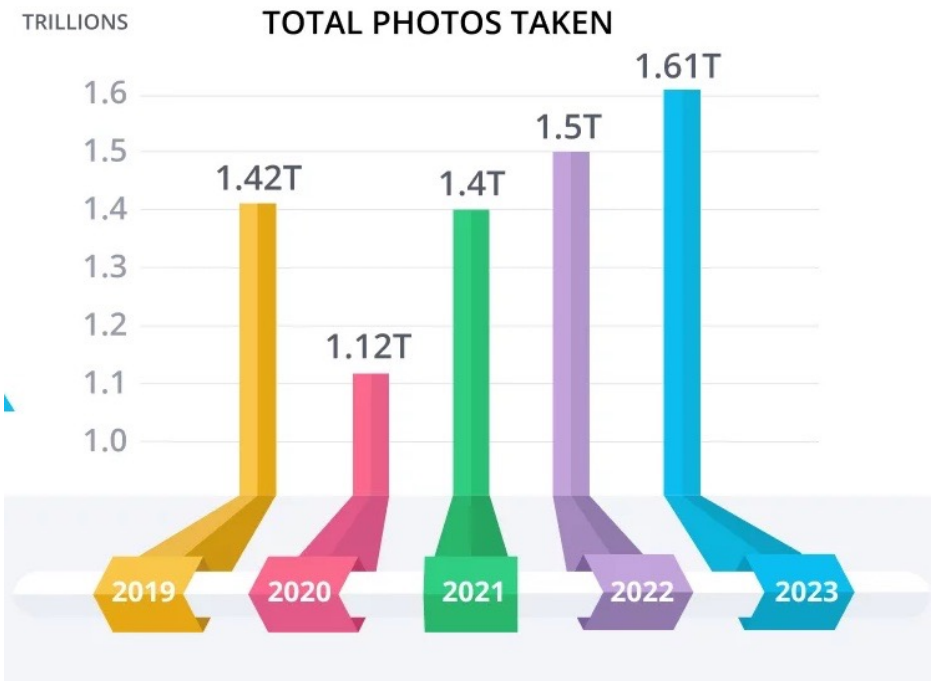



- Joint Photographic Experts Group
  - ISO/IEC
  - ITU-T
- Widely known as JPEG

# JPEG Family of Standards



# JPEG ecosystem revolutionized digital photography

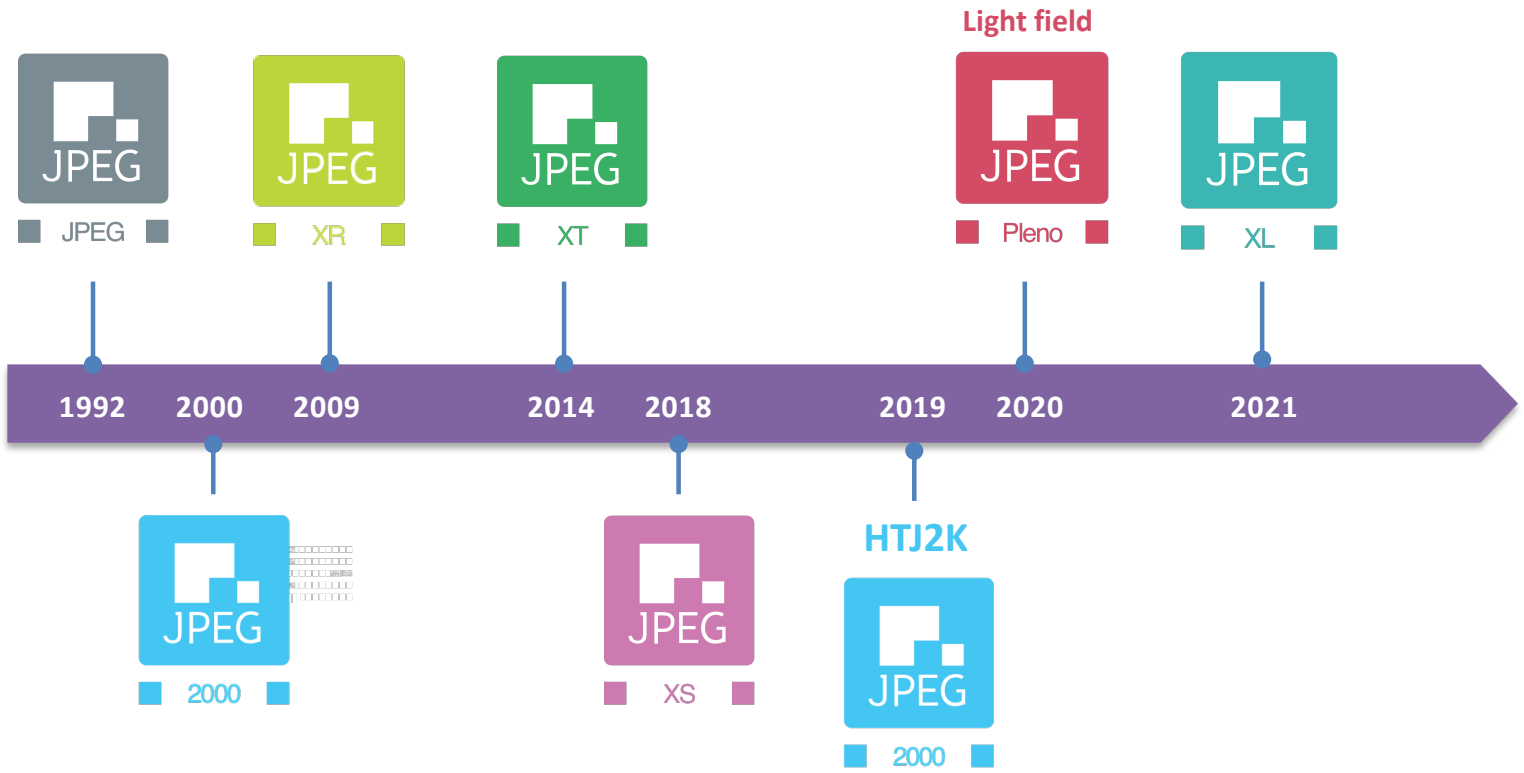



1995-96 Technology and Engineering Emmy award (together with MPEG-2)

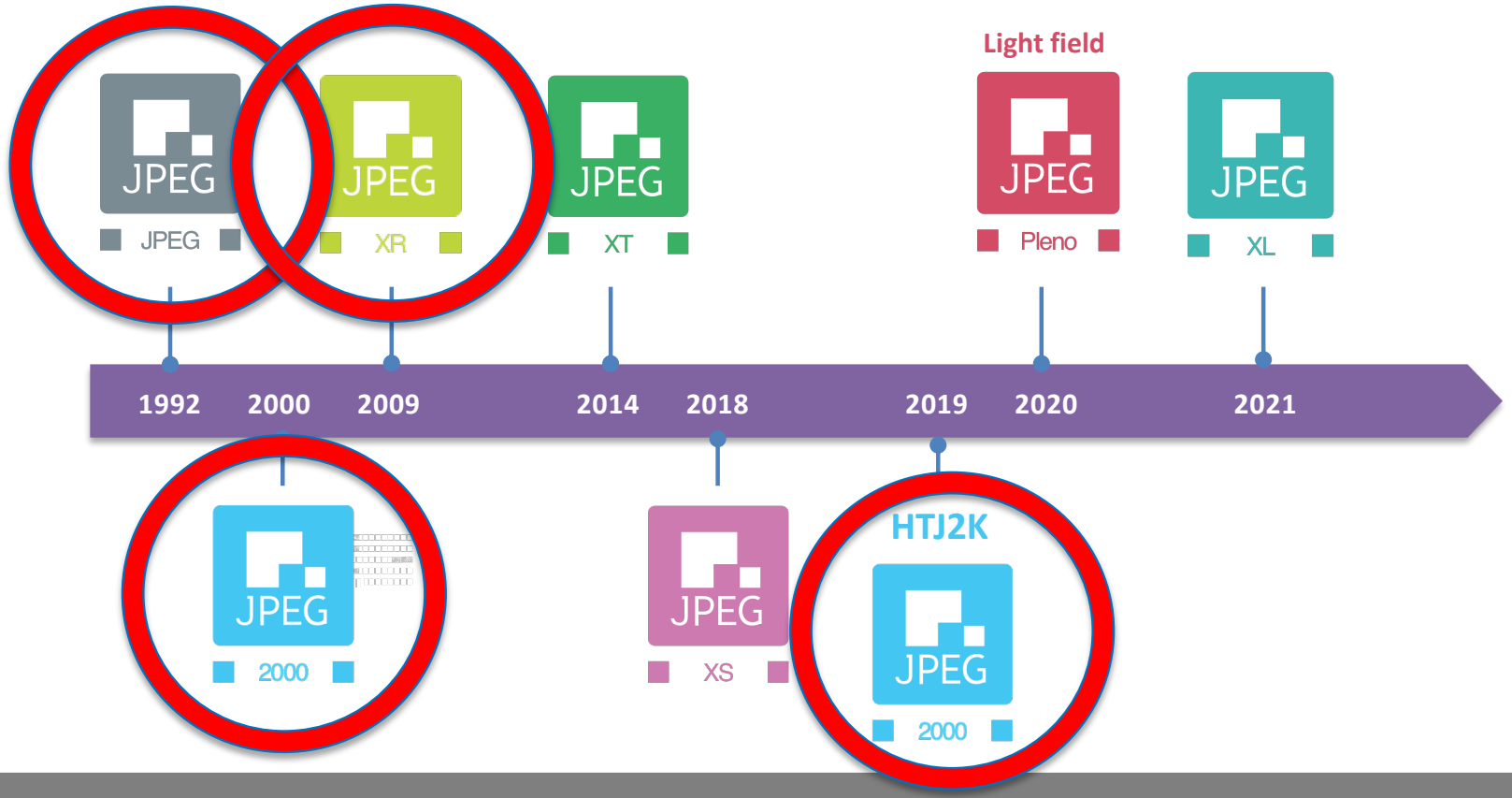
2019 Engineering Emmy award

Data source: https://focus.mylio.com/tech-today/how-many-photos-will-be-taken-in-2021

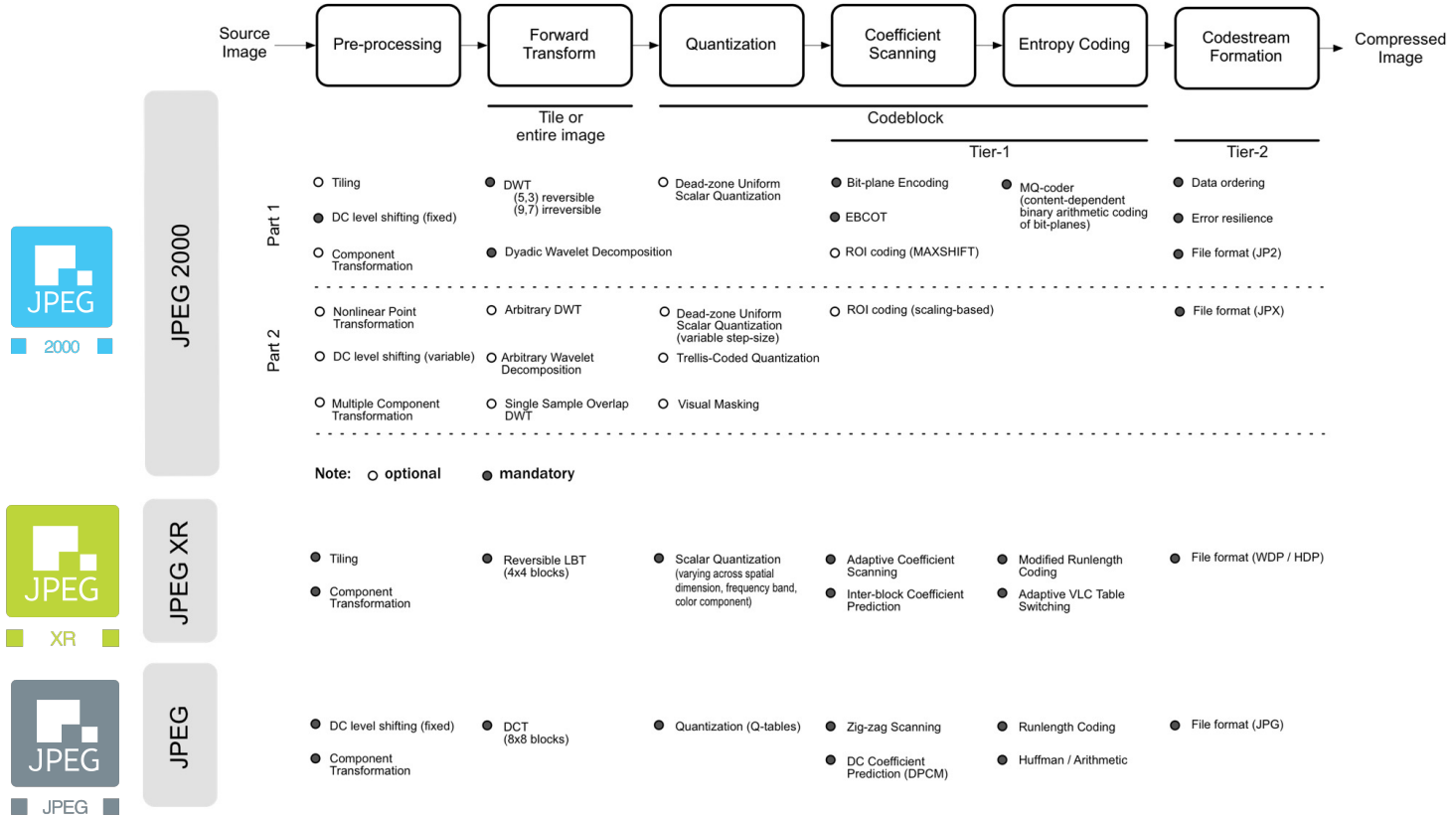
# Past JPEG image coding standards



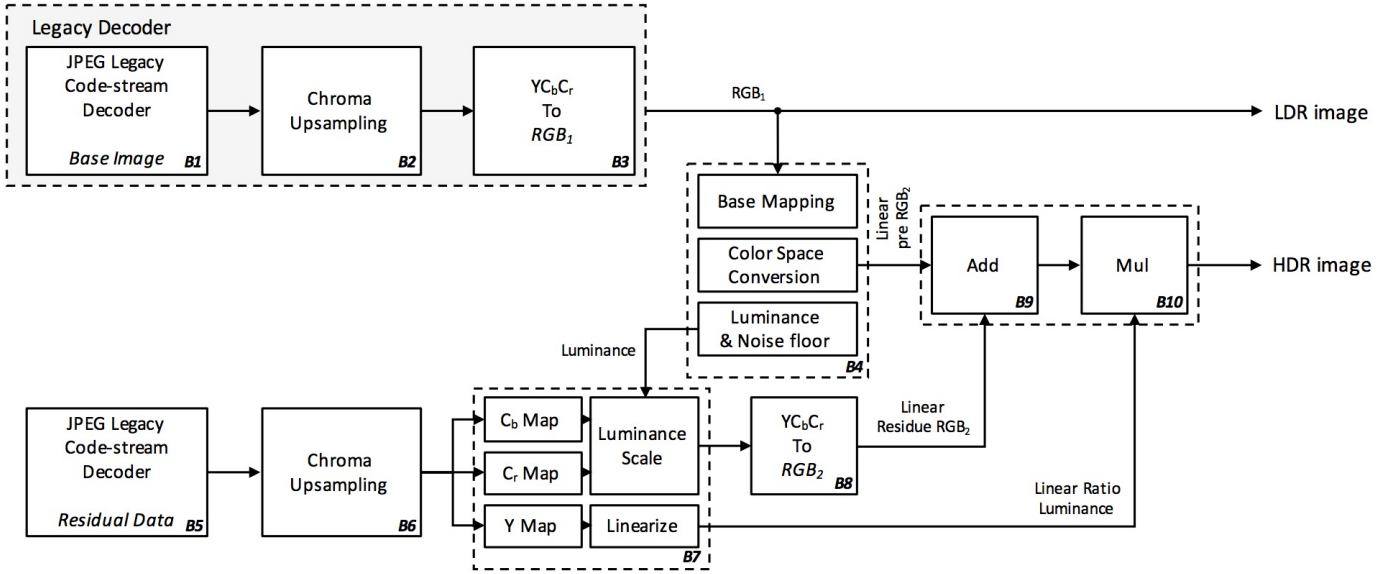
# Past JPEG image coding standards



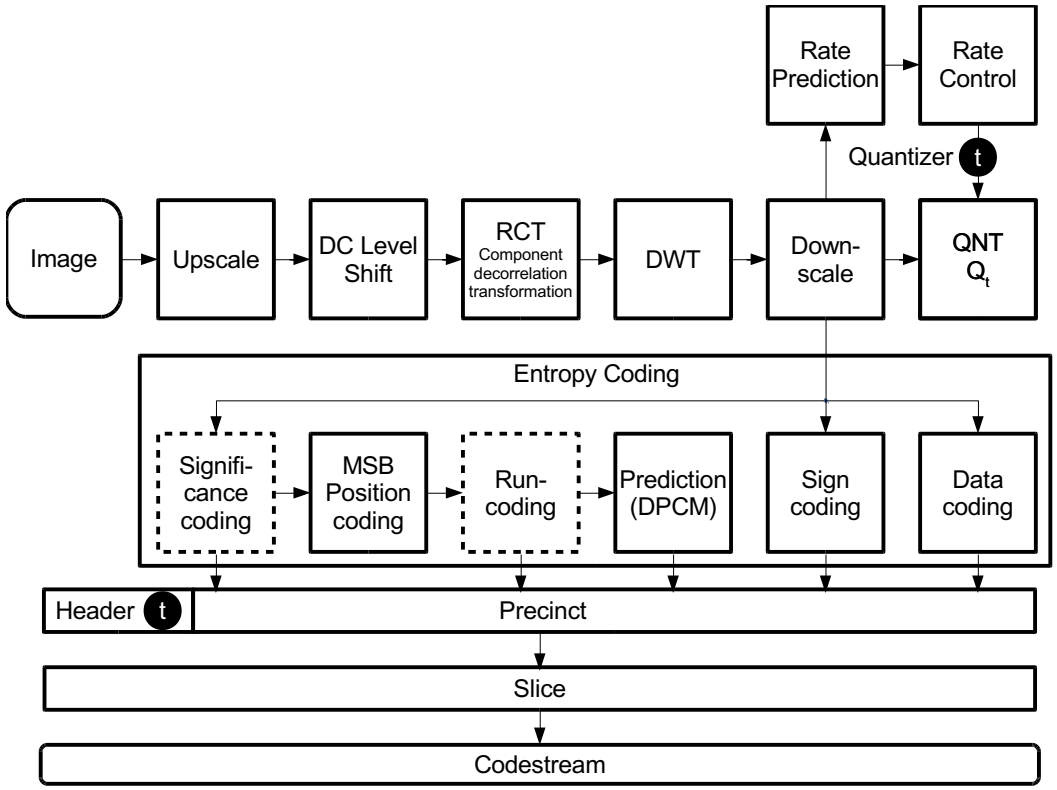
# JPEG vs JPEG 2000 vs JPEG XR



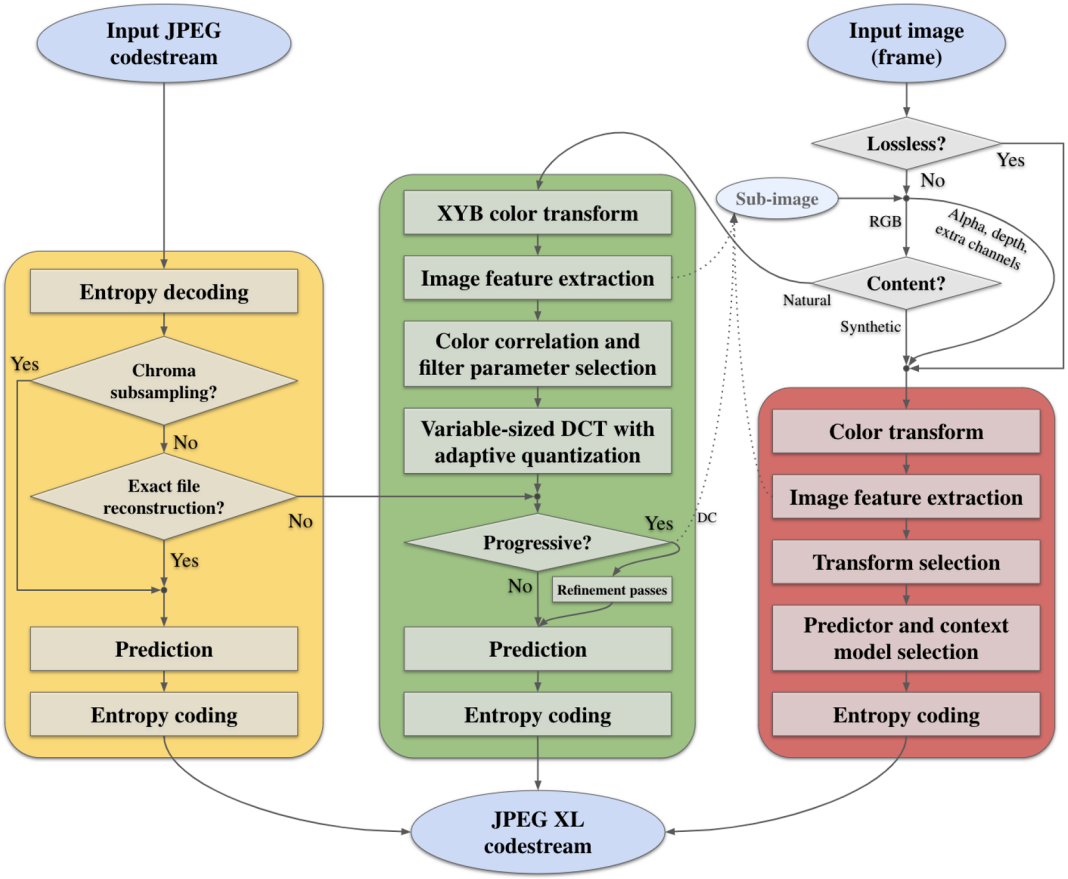
# JPEG XT coding architecture



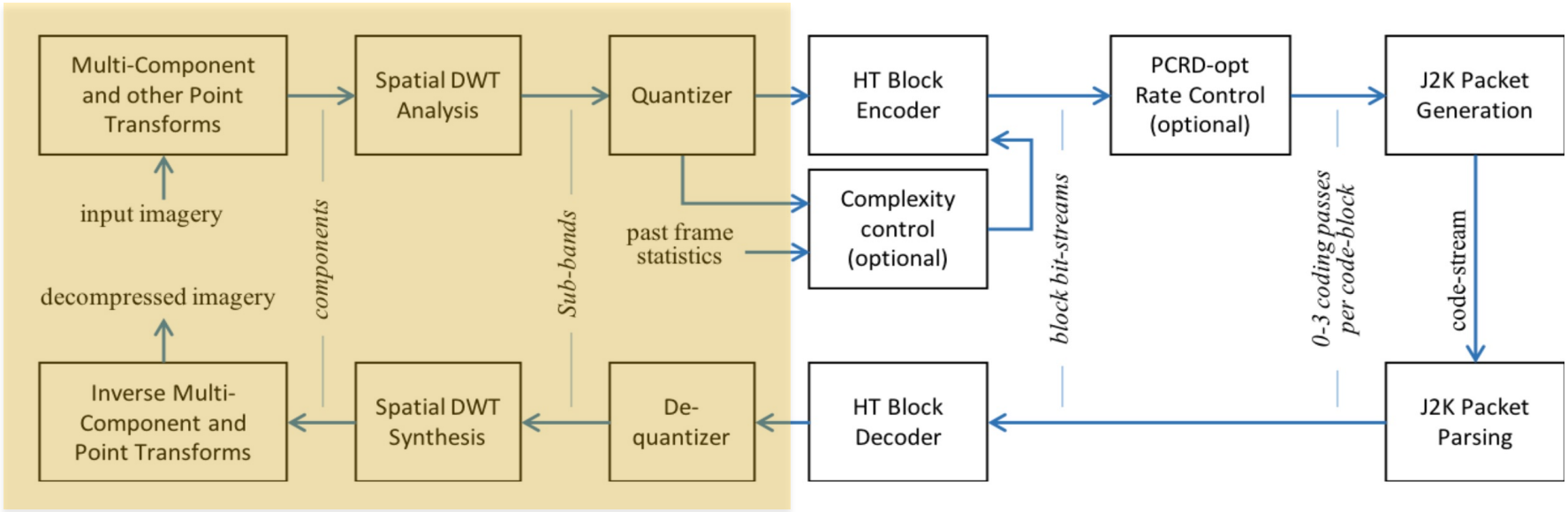
# JPEG XS coding architecture



# JPEG XL coding architecture



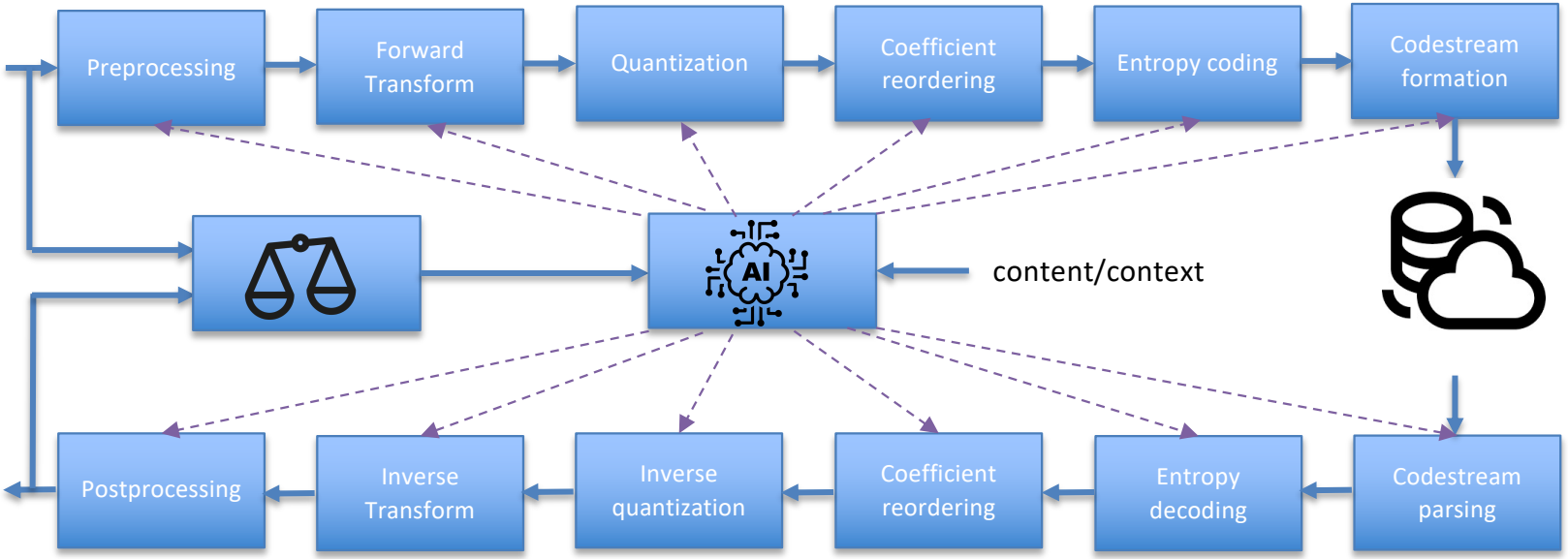
# High Throughput JPEG 2000 coding architecture



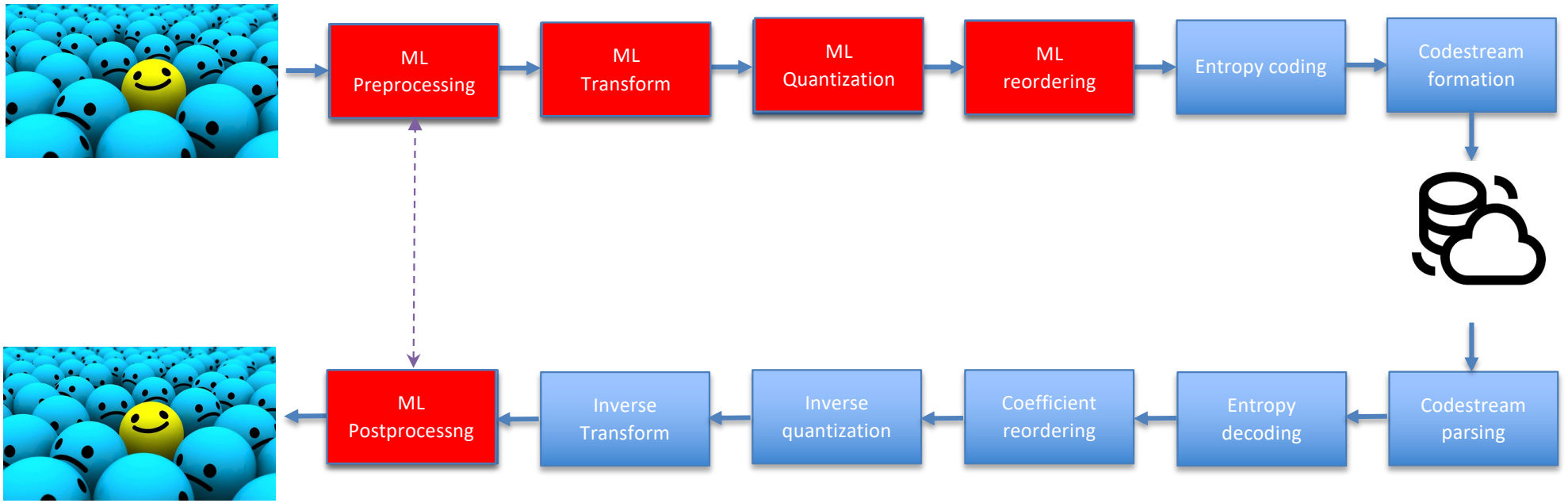
# How to take advantage of AI in coding

- Three possible alternatives
  1. AI assited codec optimization
  2. Component replacement by ML tools (e.g. NN)
  3. End-to-end autoencoders

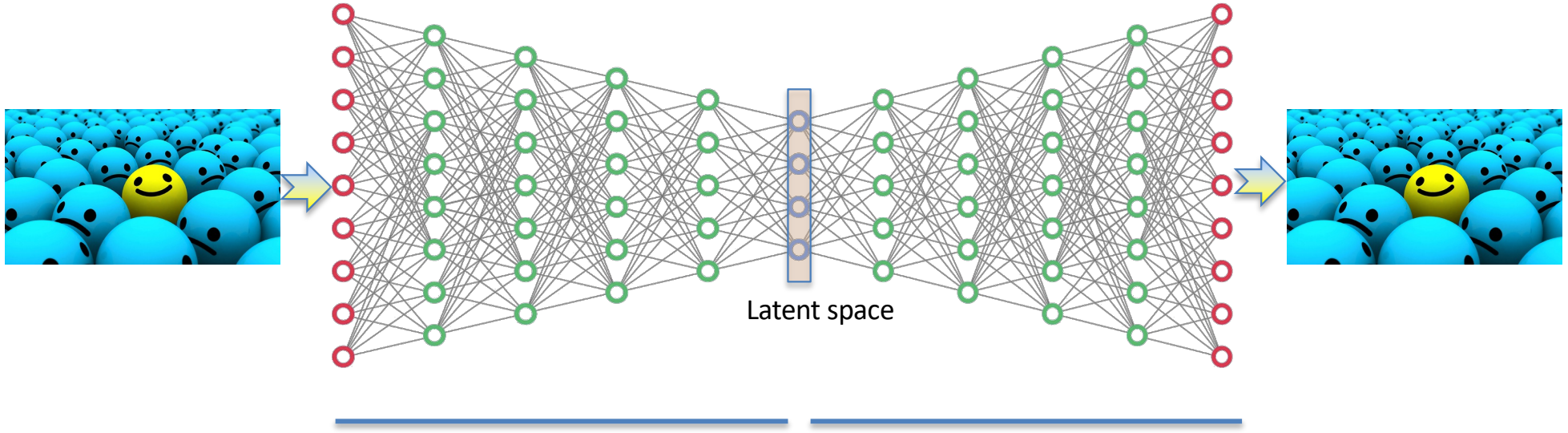
# AI assited codec optimization



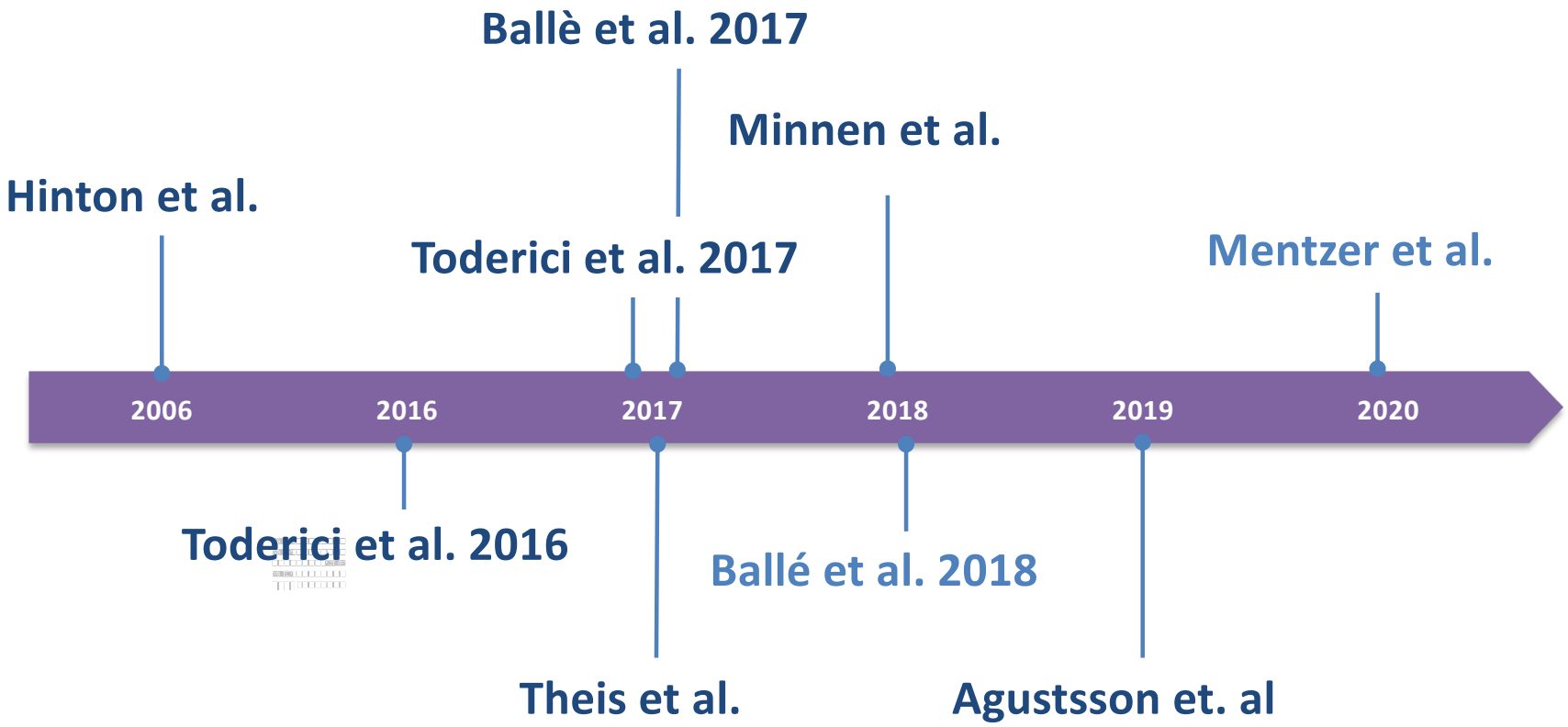
# Component replacement by ML tools



# A radically different coding architecture



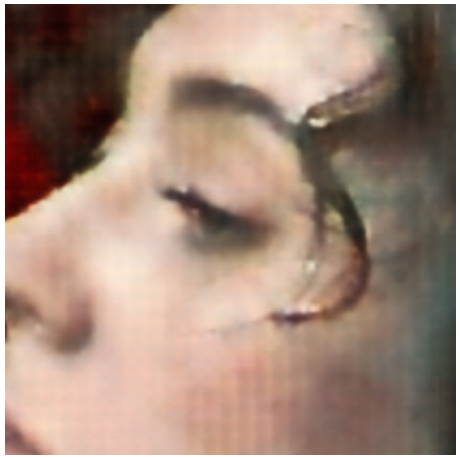
# Learning-based Image Compression Timeline



# Learning-based Image Compression

JPEG – 0.08bpp

Toderici et. al. – 0.06bpp

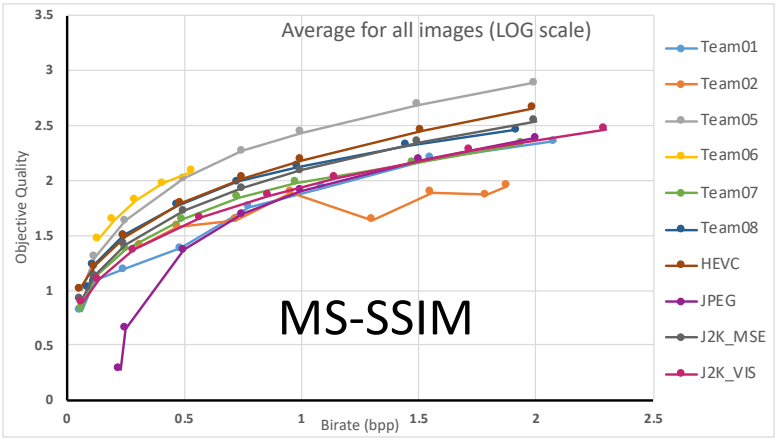


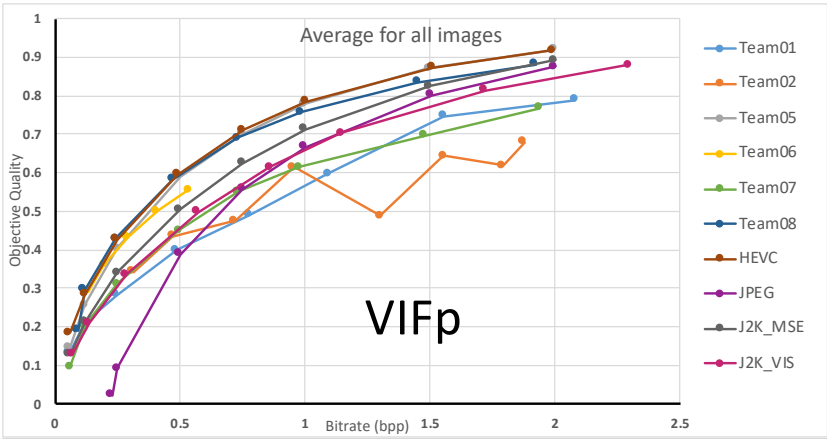
Ballè et. al. – 0.07bpp

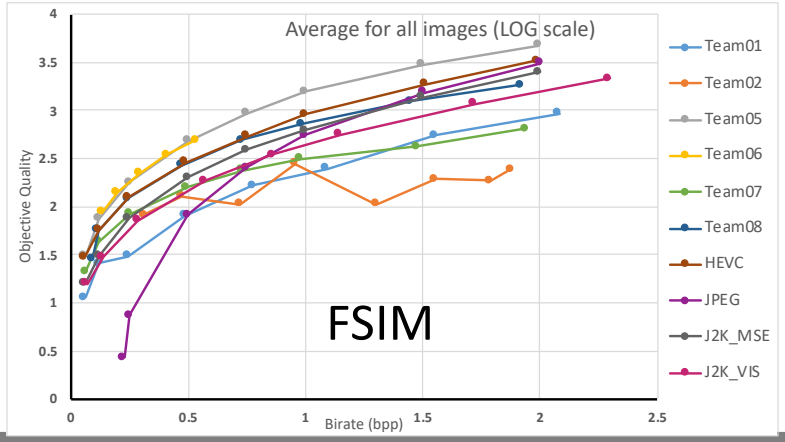
Mentzer et al. – 0.1bpp

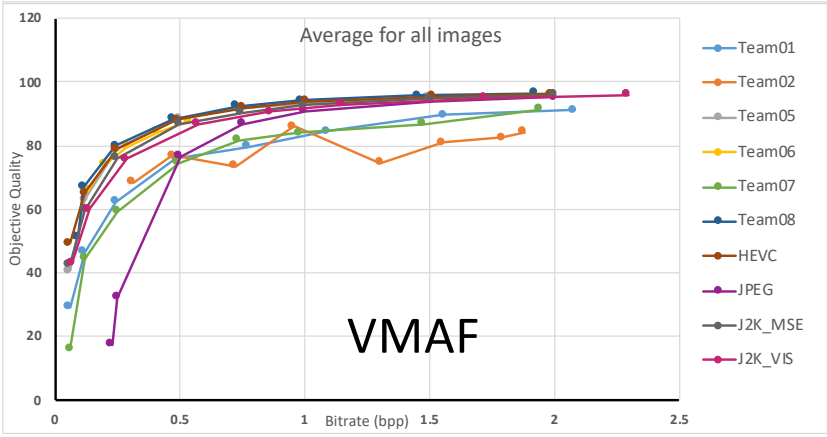
**1992** **2017** **2018** **2020**

# JPEG AI CfE results (objective metrics)



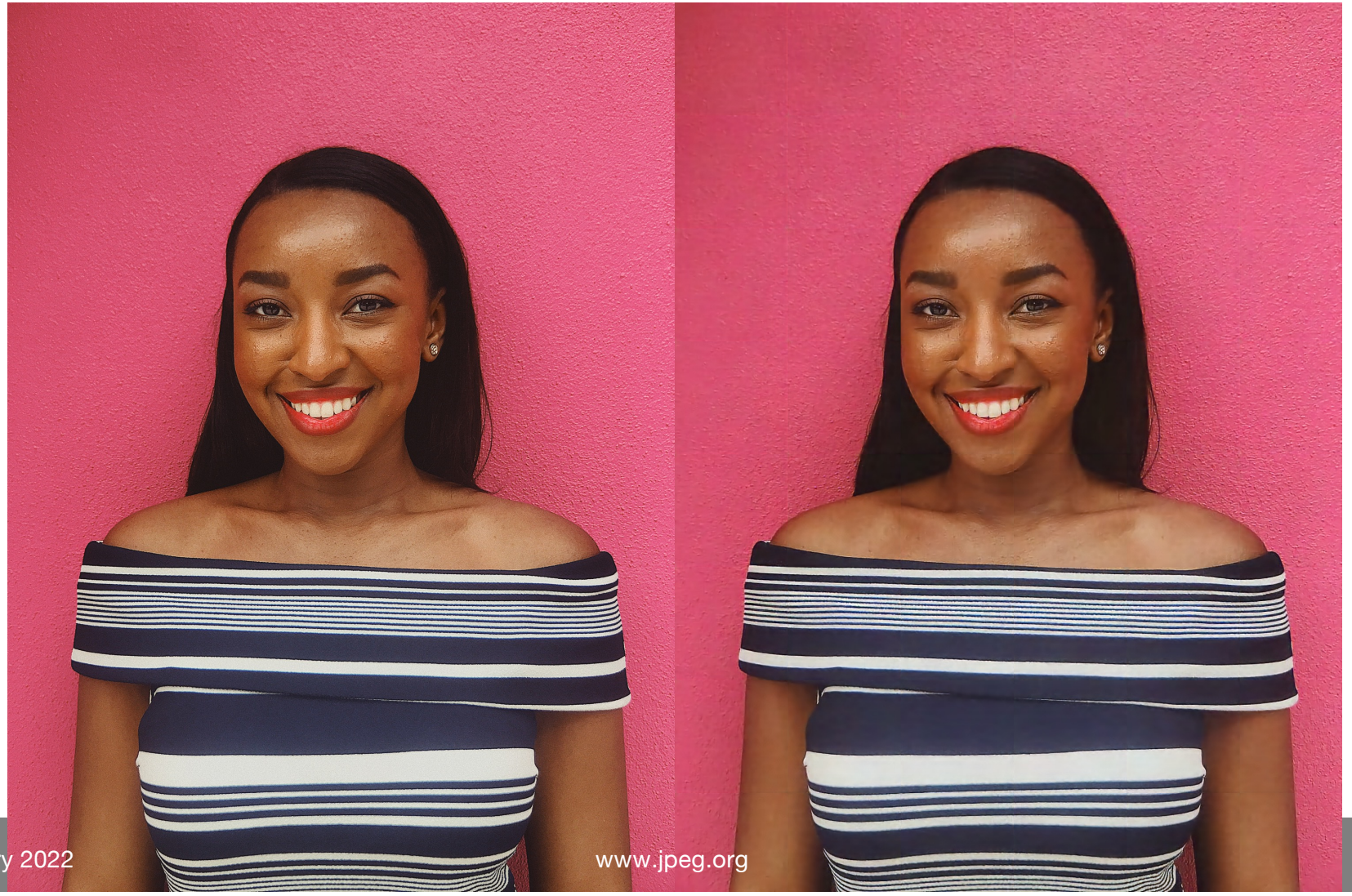



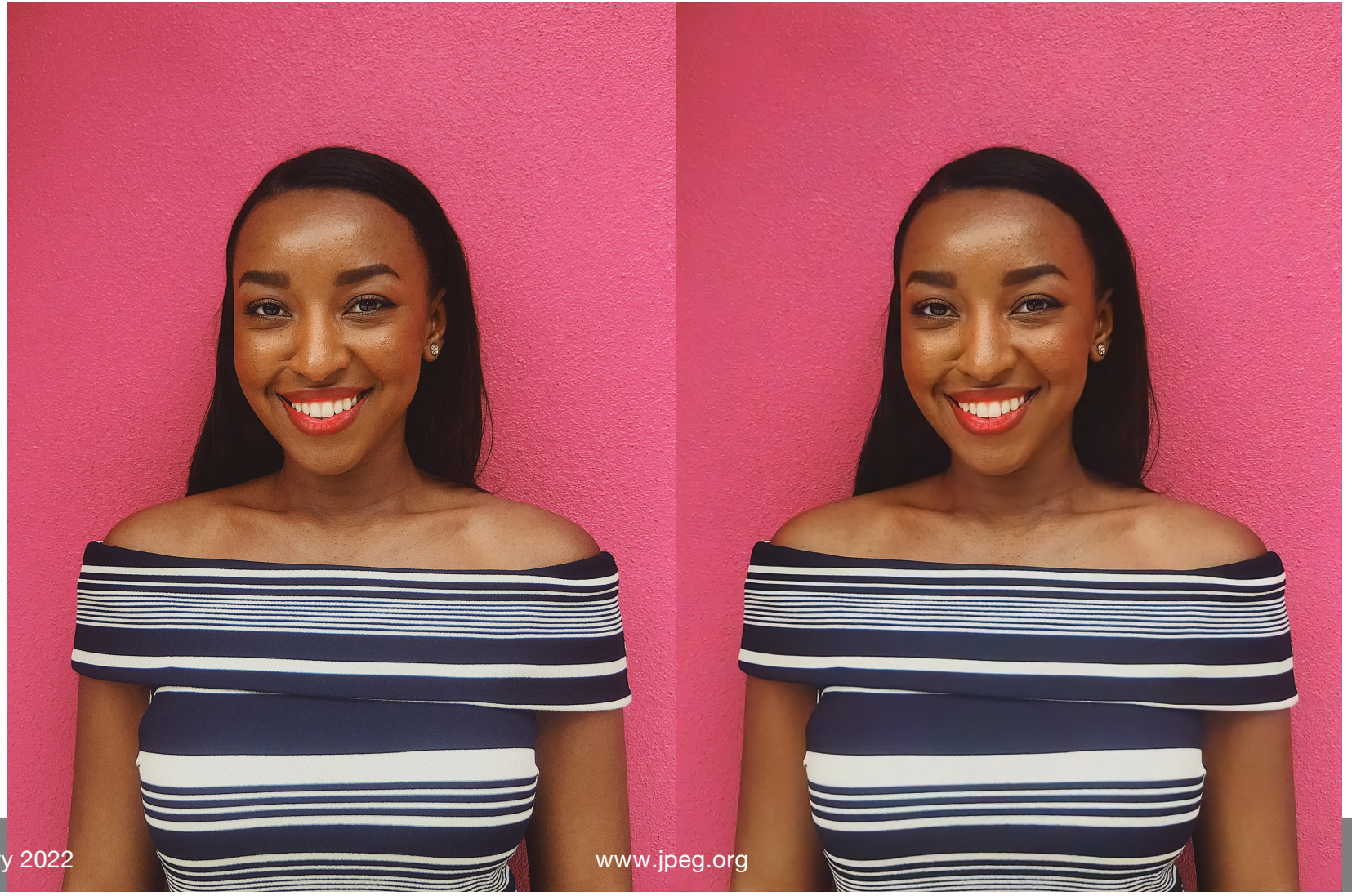
Team02 @ 0.28 bpp

Woman



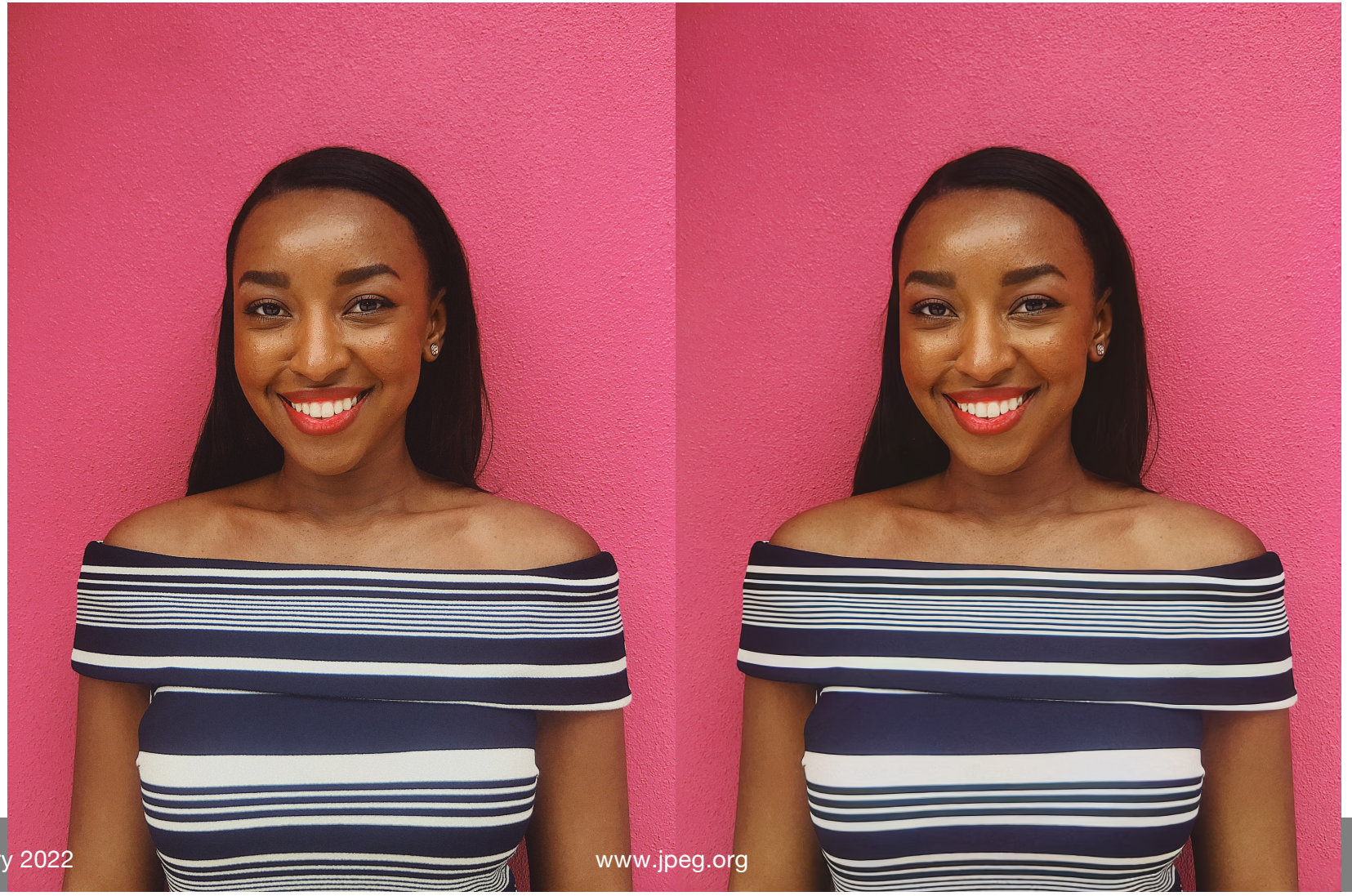
Team05 @ 0.25 bpp

Woman



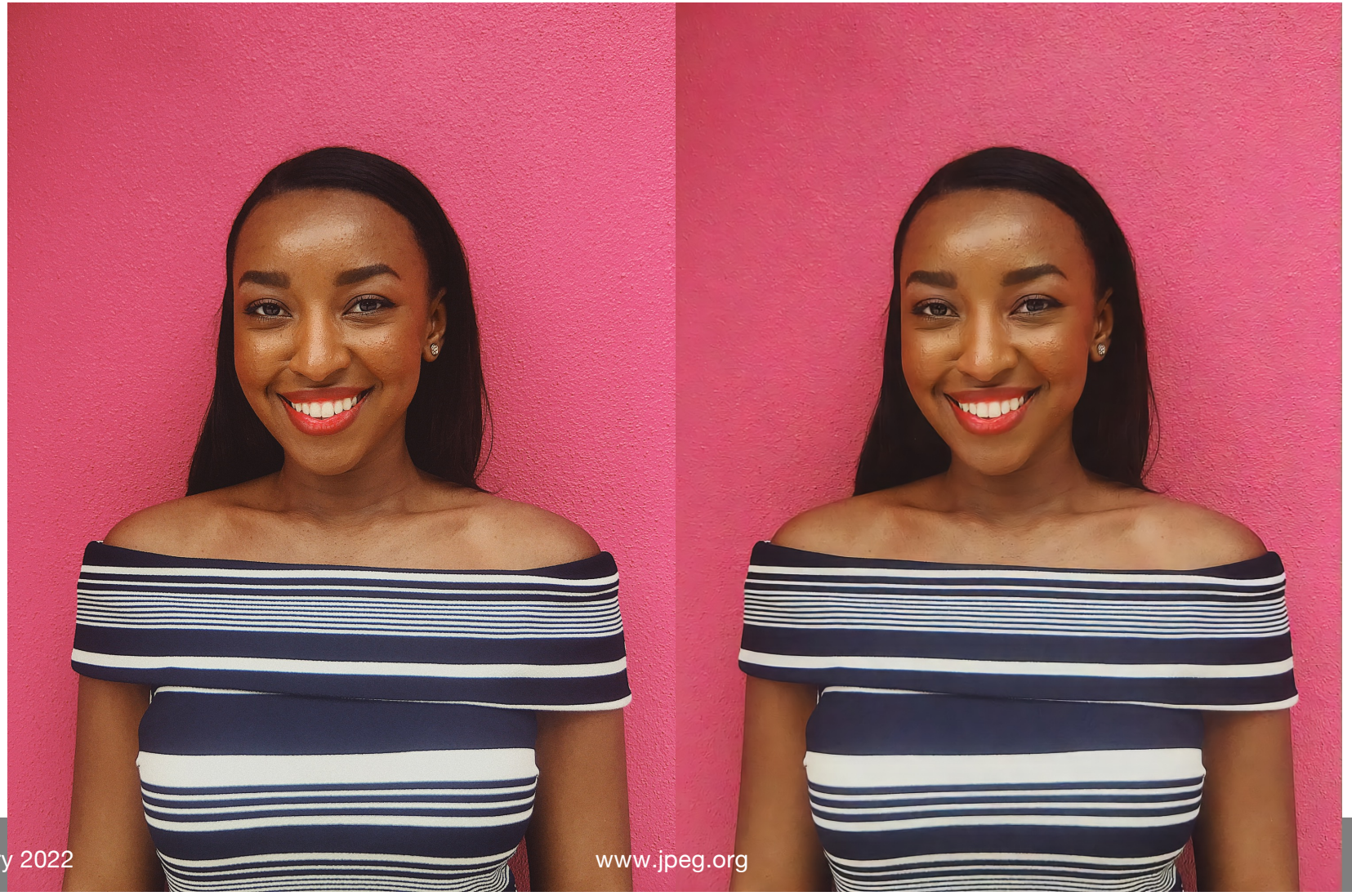
Team06 @ 0.25 bpp

Woman



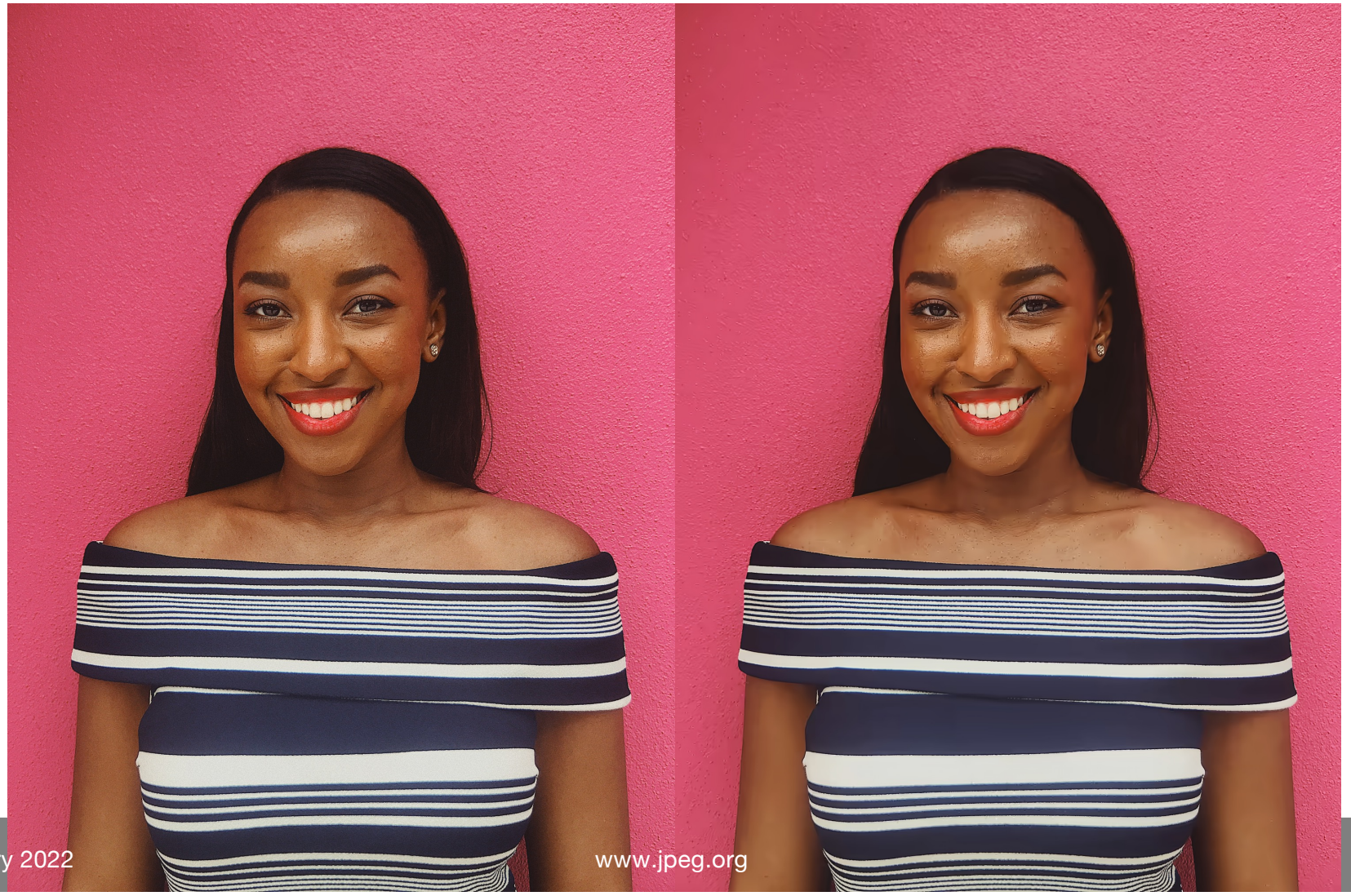
Team07 @ 0.25 bpp

Woman



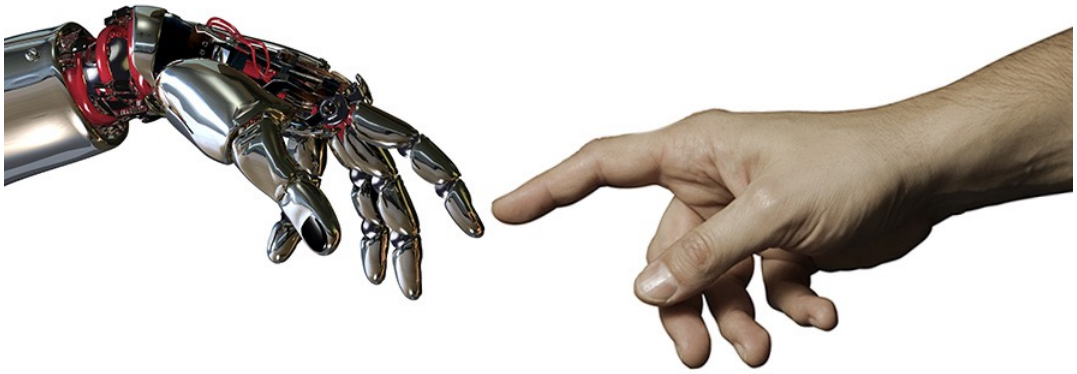
Team08 @ 0.25 bpp

Woman

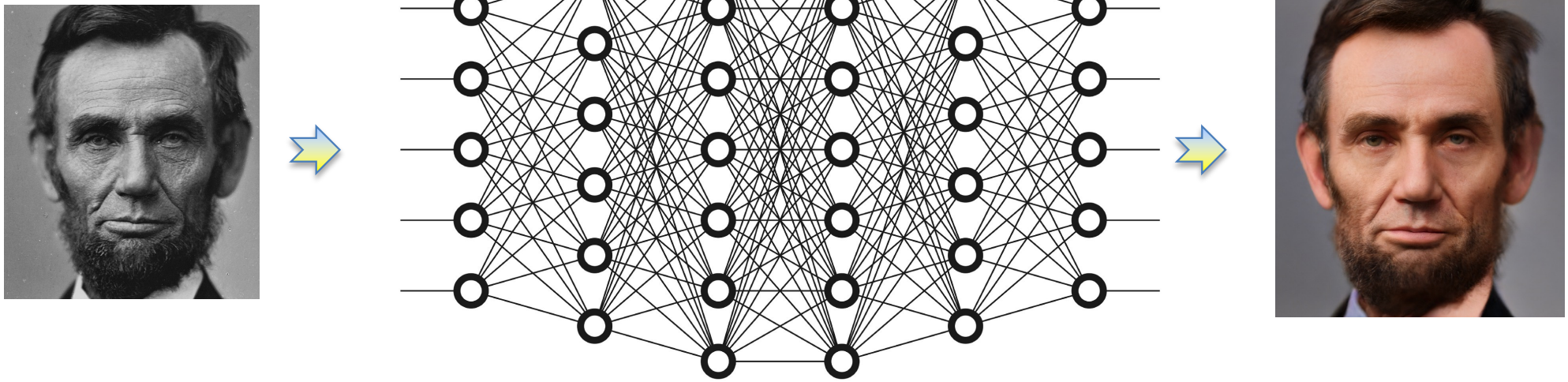


# Image coding for humans and machines

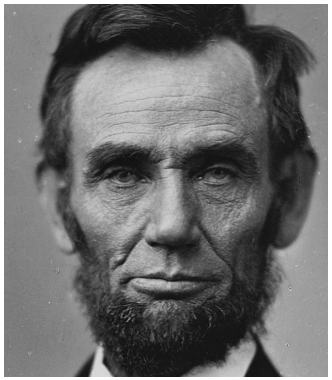
- There is more in AI based image coding that meets the eyes
  - AI is extensively used in image enhancement and machine vision
  - An image coding for machines and another for humans divides the ecosystem
  - Can we put both under the same framework?

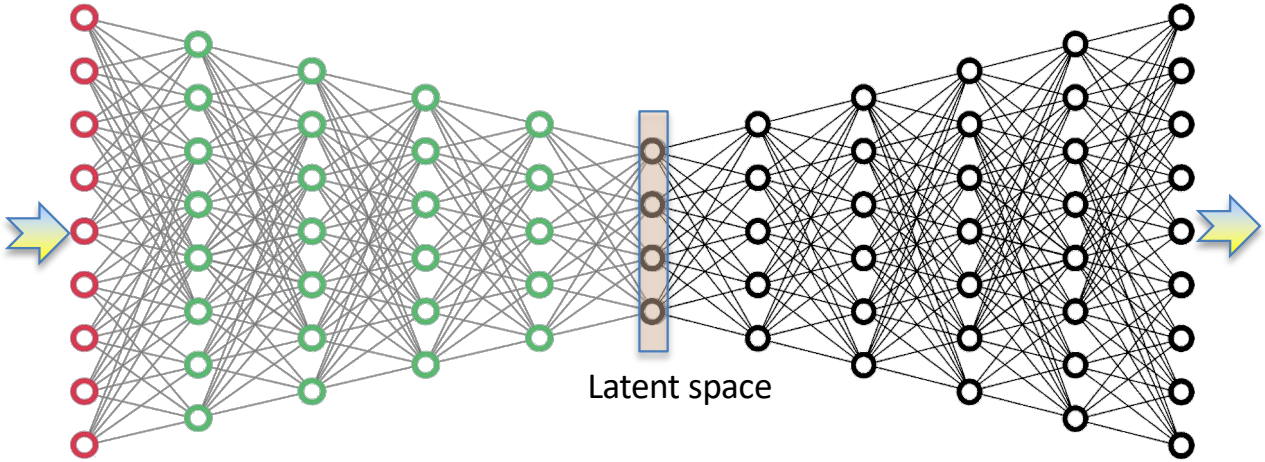


# AI in image enhancement



# AI in image enhancement

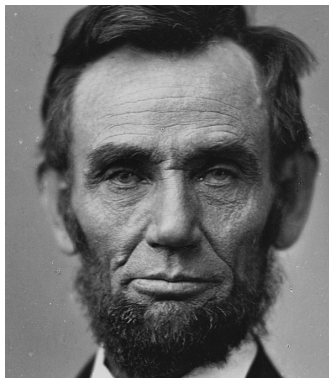


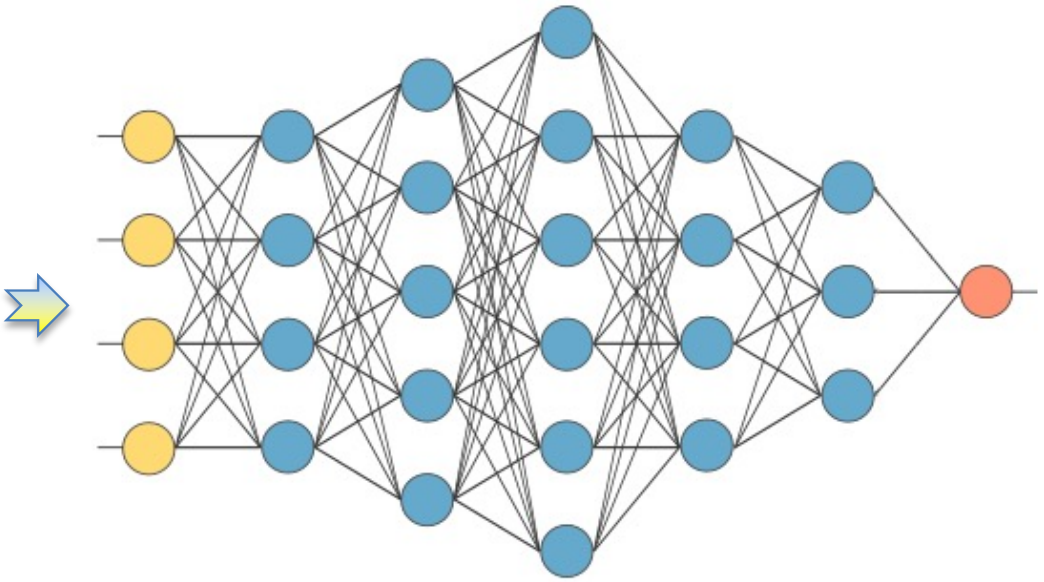



Encoder Decoder

Autoencoder

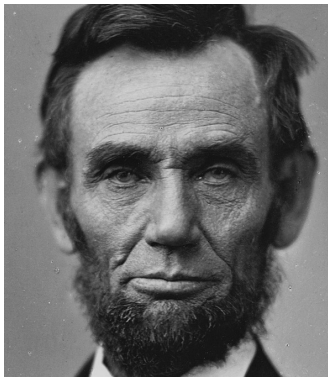
# AI in machine vision

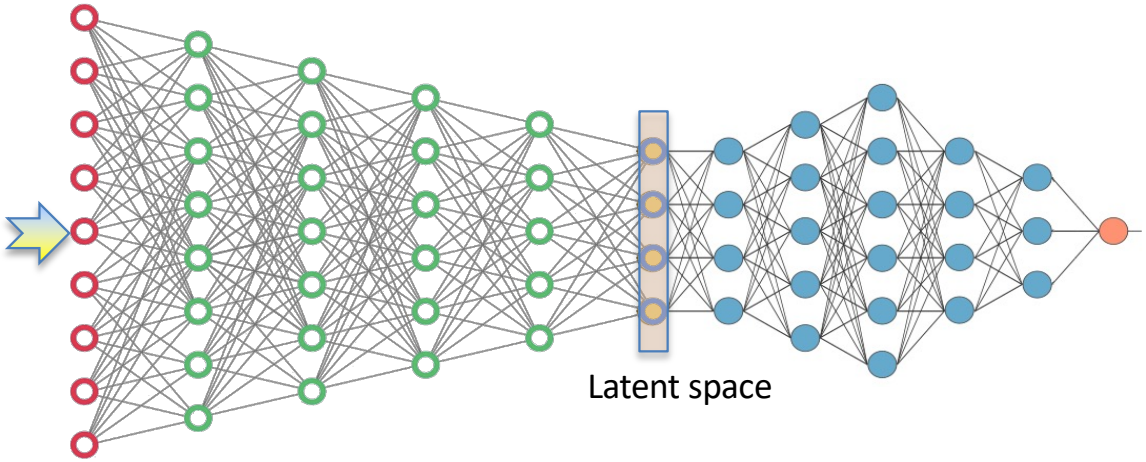




Abraham Lincoln

# AI in machine vision






Abraham Lincoln

Encoder

Decoder

**Autoencoder**

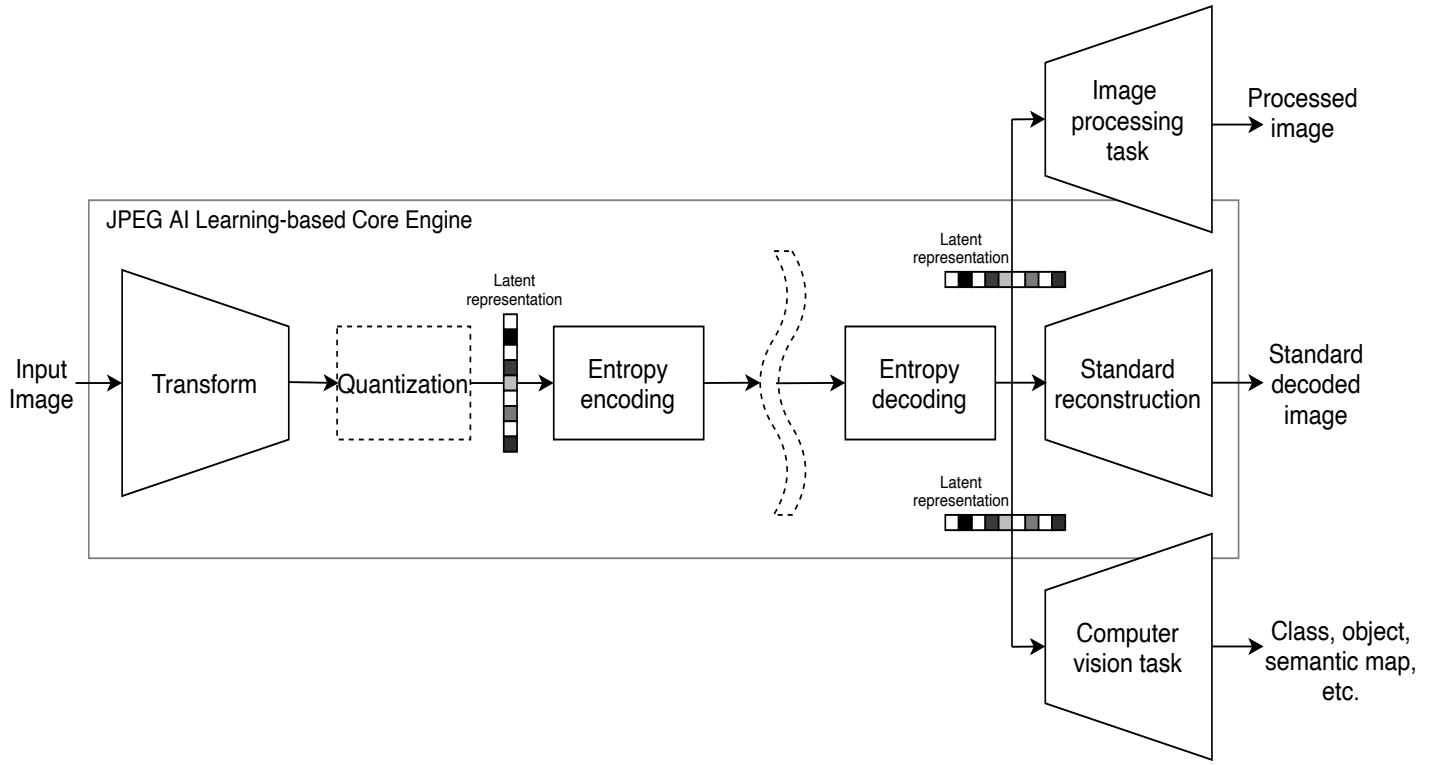
# JPEG AI Scope (ISO/IEC 6048)

The JPEG AI scope is the creation of a learning-based image coding standard offering a **single-stream**, **compact**, compressed domain representation, targeting both **human visualization**, with significant compression efficiency improvement over image coding standards in common use at equivalent subjective quality, as well as effective performance for **image processing** and **computer vision tasks**, with the goal of supporting a **royalty-free baseline**.

**Advantages:**

- Same compressed stream is useful for decoding as well as image processing and computer vision tasks
- Reduces the resources needed to perform image processing and computer vision tasks
- Feature extraction from original instead of decompressed images

# JPEG AI Framework: a Triple-Purpose Approach



# AI in JPEG

- The same triple-purpose approach is applied to JPEG Pleno standard:
  - Starting from JPEG Pleno Point Cloud Coding

# More information

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