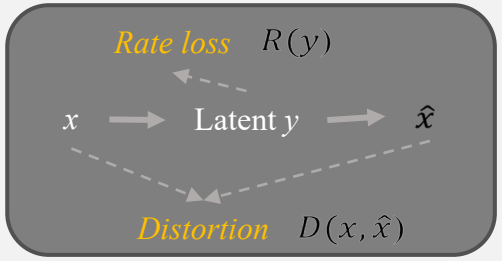
Online Meta Adaptation for Variable-Rate Learned Image Compression

Wei Jiang, Wei Wang, Songnan Li, Shan Liu Tencent America LLC

Learned Image Compression (LIC)

Target

Learn a latent y good for compression and reconstruction



Existing Challenges

Variable-rate issue

RD training loss $\lambda D(x,\hat{x}) + R(y)$

One model for each tradeoff λ

Mismatch issue

Soft approximate quantization in training

True hard quantization at test time

Motivation

Online learning

Ground-truth on encoder side at test time

Per-datum adaptation to reduce the mismatch

Meta learning

Tradeoff λ as meta information

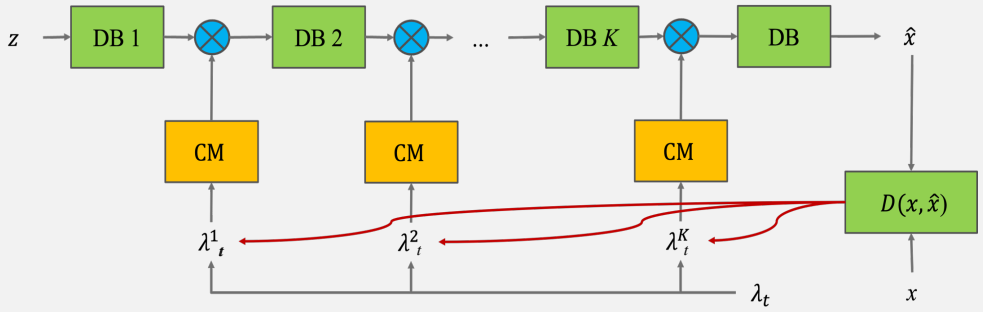
Meta trained decoder for variable-rate reconstruction

Online meta learning

Update and transmit a few meta control parameters instead of model parameters: fast stable updates, little transmission overhead

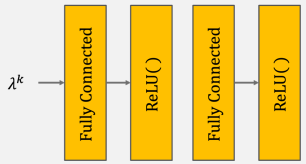
Complementary to prior arts: improved entropy model, mixed quantization, variable-rate models

Online Meta LIC

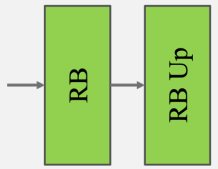


CM

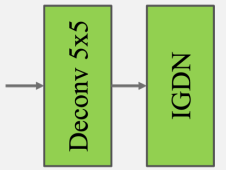
conditional feature modulation



DB for Cheng2020



DB for Minnen2018



Online learning in encoder

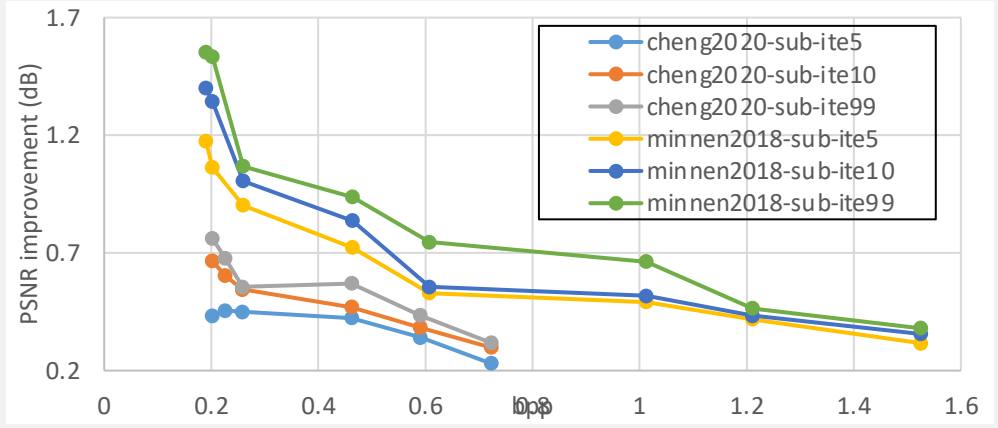
Initialized as target λ_t

Direct SGD to update based on distortion

Reconstruction in decoder

Transmit updated $\lambda_t^1, \ldots \lambda_t^K$ to decoder

Reconstruct as usual



Experiments

MMSP LBIC challenge (5000/350/40 train/val/test data)

Setup

Cheng2020 (6 pretrained λ settings) *[Cheng et al. CVPR 2020]*

Minnen2018 (8 pretrained λ settings) *[Minnen et al., ICML 2018]*

CompressAI PyTorch Pretrained mono-rate encoder

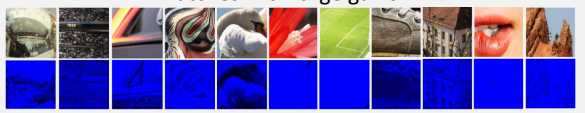
Retrained variable-rate decoder

K=4: transmitting 4 numbers to decoder

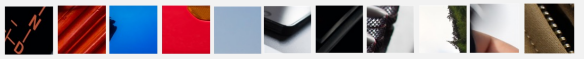
Result

1% encoding time increase, 1.5%~5% gain, for 5 iterations

Patches with large gains



patches without gains



More gain for lower bitrates