VSP Final Project
Image Coding Contest

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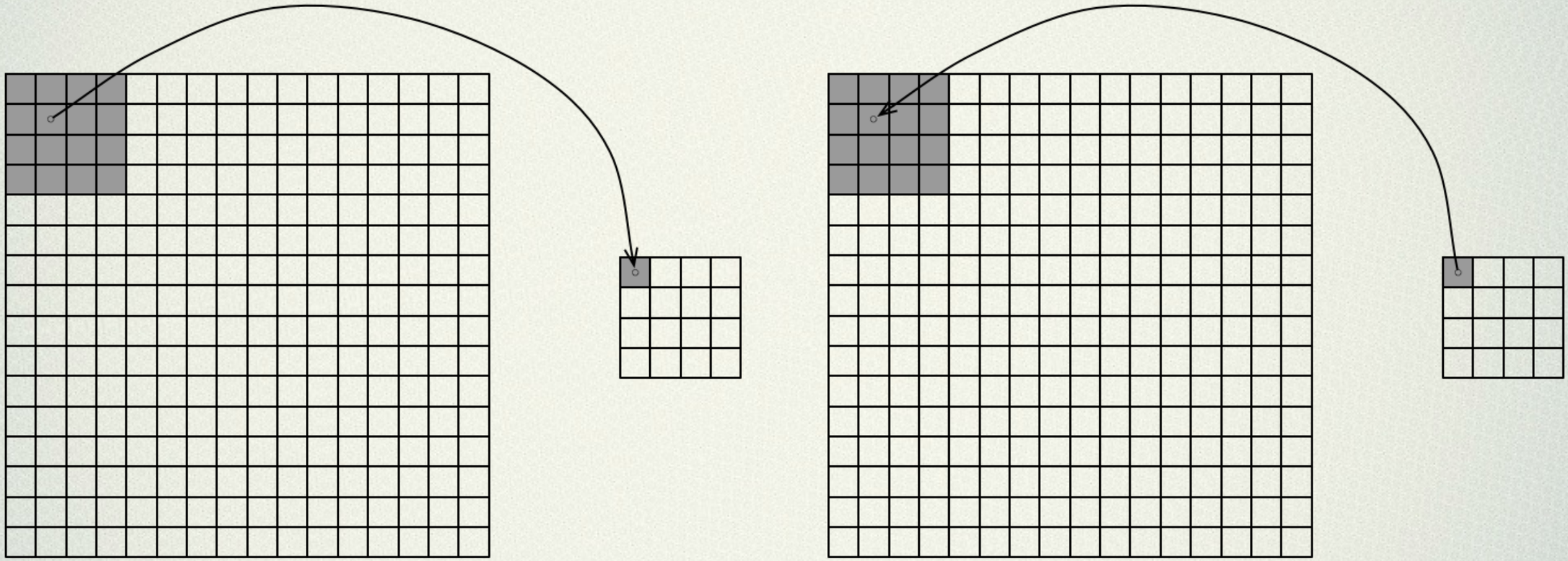
Coding System

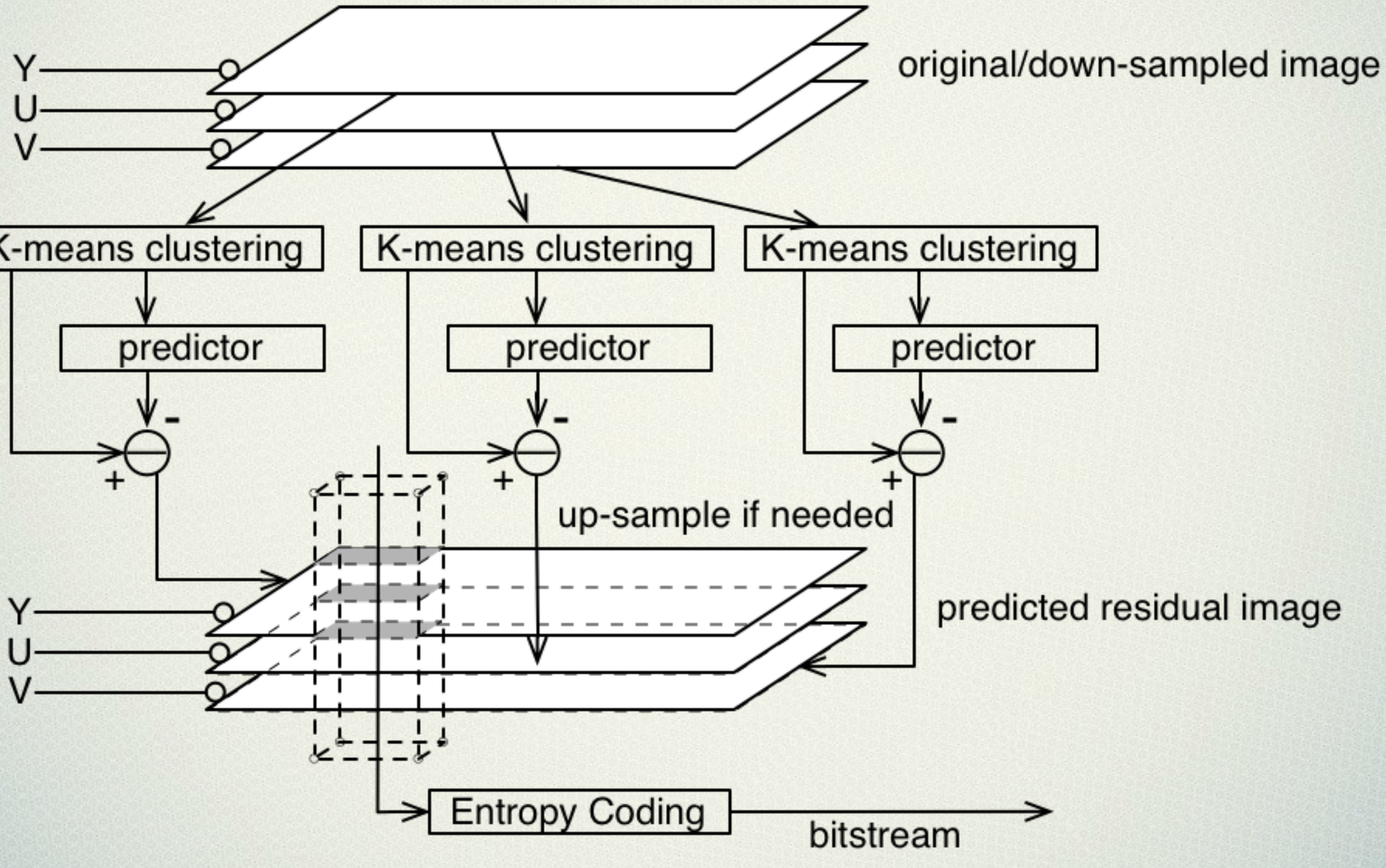
- Pre-down-sampling
  - For low-bitrate constraint coding.
- Level 1 coding
  - Main level: lower the entropy.
- Level 2 coding
  - Optional level: for PSNR compensation.

Down/Up Sampling

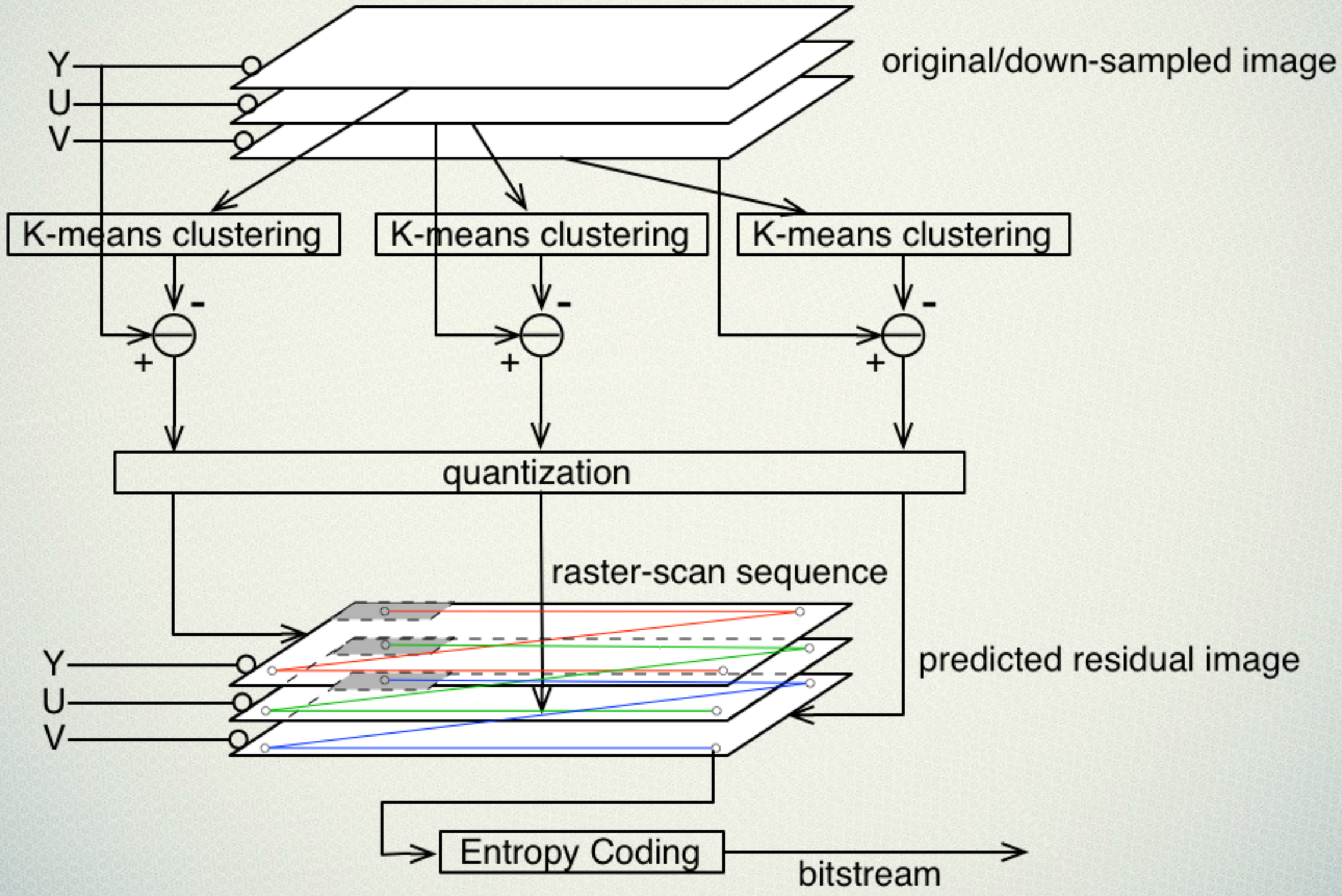


1	$\log_2(\mathrm{dsr})$	down-sample rate of width
1	$\log_2(\mathrm{dsr})$	down-sample rate of height

Level 1 Coding



Level 2 Coding

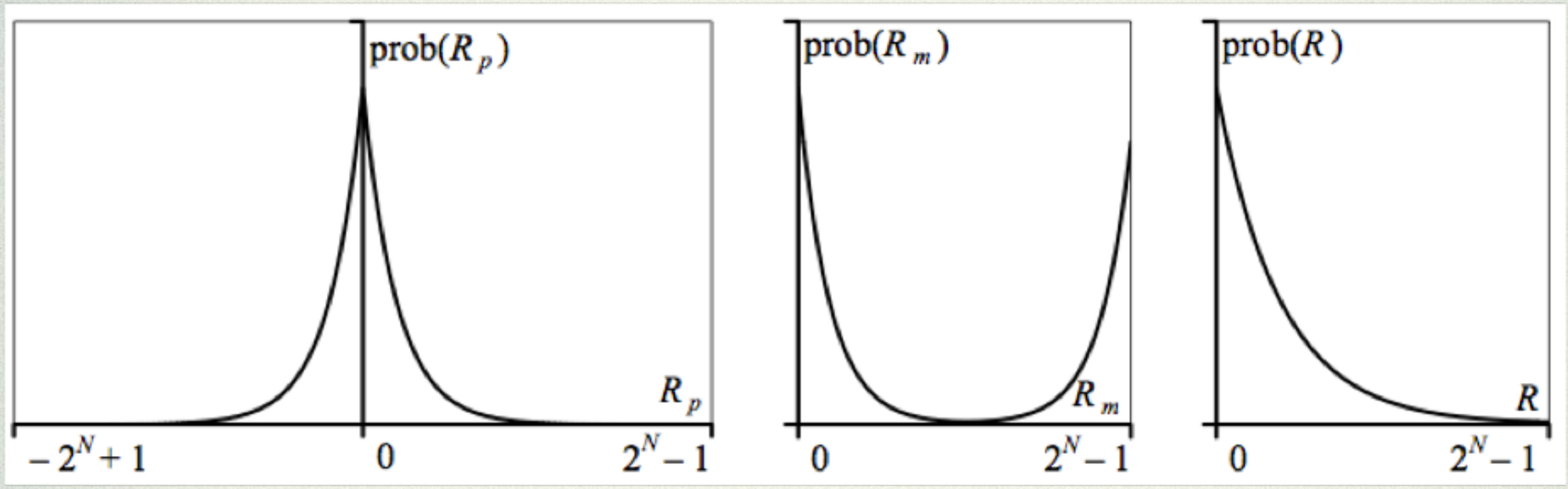


Predictors

C	B
A	D

~~Pred0(X) = 0~~	Pred3(X) = C	Pred6(X) = B + (A - C)/2
Pred1(X) = A	Pred4(X) = A + B - C	Pred7(X) = (A + B)/2
Pred2(X) = B	Pred5(X) = A + (B - C)/2	Pred8(X) = (3A + 3B - 2C)/4

Negative Difference Handling



raw data

raw data % $2^N - 1$

0	-1	1	-2	2	-3	3

-4	-3	-2	-1	0	0	1	2	3	4

$-4Q_{res}$ $-3Q_{res}$ $-2Q_{res}$ $-Q_{res}$ 0 Q_{res} $2Q_{res}$ $3Q_{res}$ $4Q_{res}$

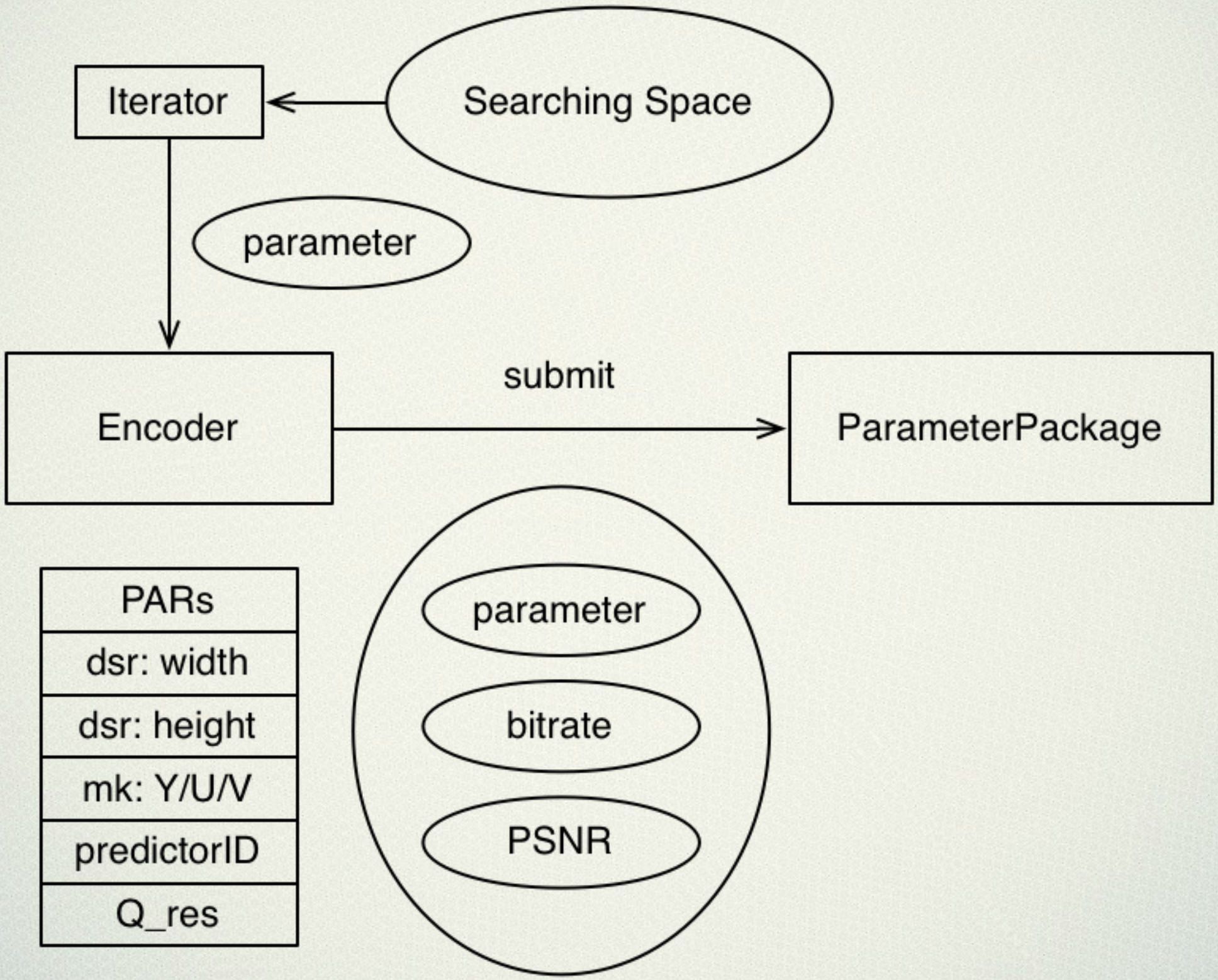
Bitstream Format

TAG	BITS	DESCRIPTION
$\log_2(\mathrm{dsr})$	1+1	down-sample rate (of width/height)
width	16	image width
height	16	image height
format	1 or 2	4:2:0 I 4:2:2 I 4:4:4
m_Y	3	bits per class symbol of Y
y-center[0]	8	the first Y center value
⋮	⋮	
y-center[end]	8	the last Y center value
m_U	3	bits per class symbol of U
u-center[0]	8	the first U center value
⋮	⋮	
u-center[end]	8	the last U center value
m_V	3	bits per class symbol of V
v-center[0]	8	the first V center value
⋮	⋮	
v-center[end]	8	the last V center value
k-predictor	3	predictor no. of k-means cluster id
N_k	32	# of k-symbols
k-symbol[0]	m_YUV	the first symbol value
⋮	⋮	
k-symbol[end]	m_YUV	the last symbol value

TAG	BITS	DESCRIPTION
m_table	8	# of bits of Huffman table
WL_max	m_table	max word length of the table
entries(1)	m_table	# of entries of word length 1
⋮	⋮	
entries(end)	m_table	# of entries of word length WL_max
k-bitstream		content of k-symbol
Q_res	8	quantization constant of the residual
N_res	8	# of residual value symbols
res-symbol[0]	8	the first symbol value
⋮	⋮	
res-symbol[end]	8	the last symbol value
m_table	8	# of bits of Huffman table
WL_max	m_table	max word length of the table
entries(1)	m_table	# of entries of word length 1
⋮	⋮	
entries(end)	m_table	# of entries of word length WL_max
res-bitstream		content of res-symbol

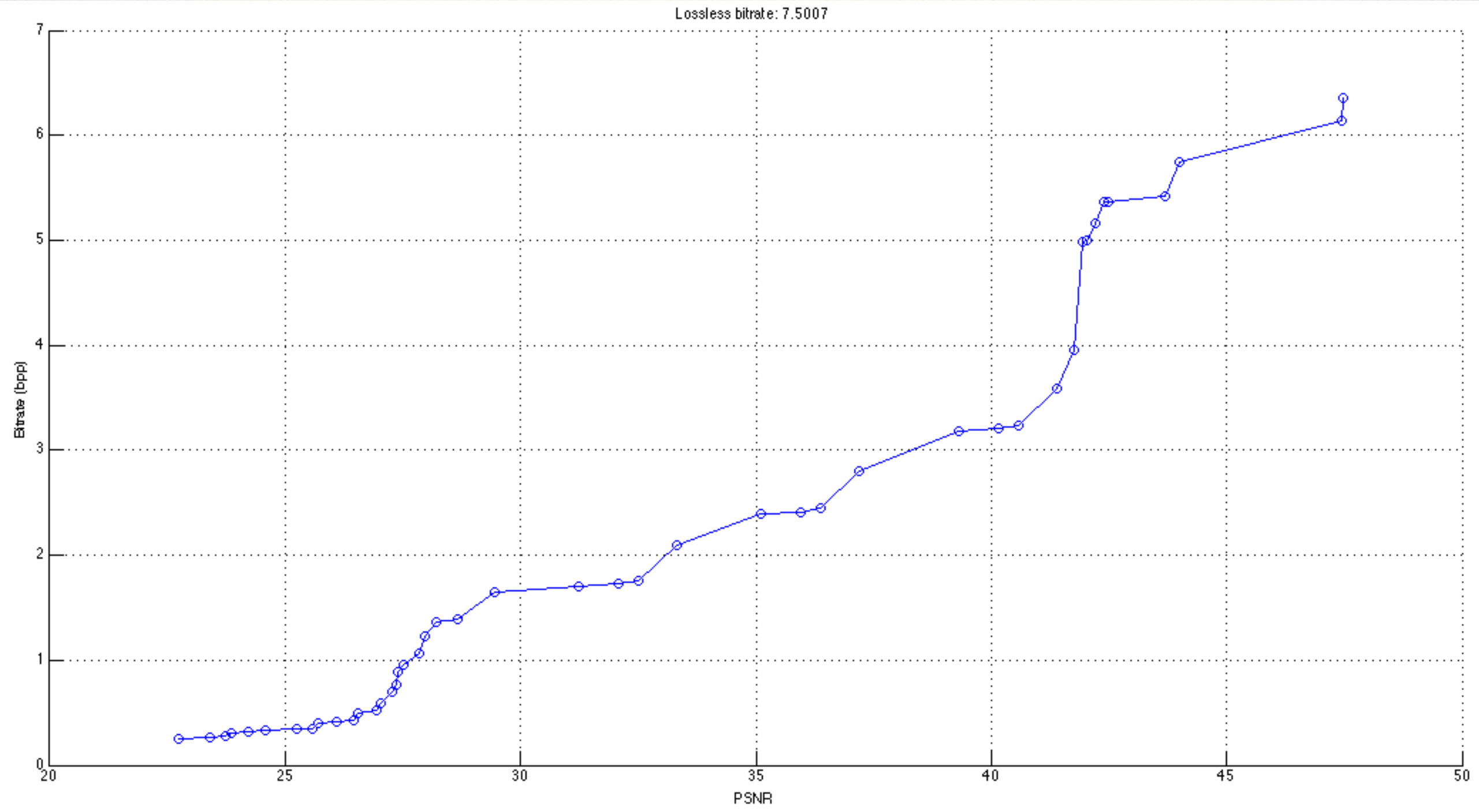
Level 2

Work Flow

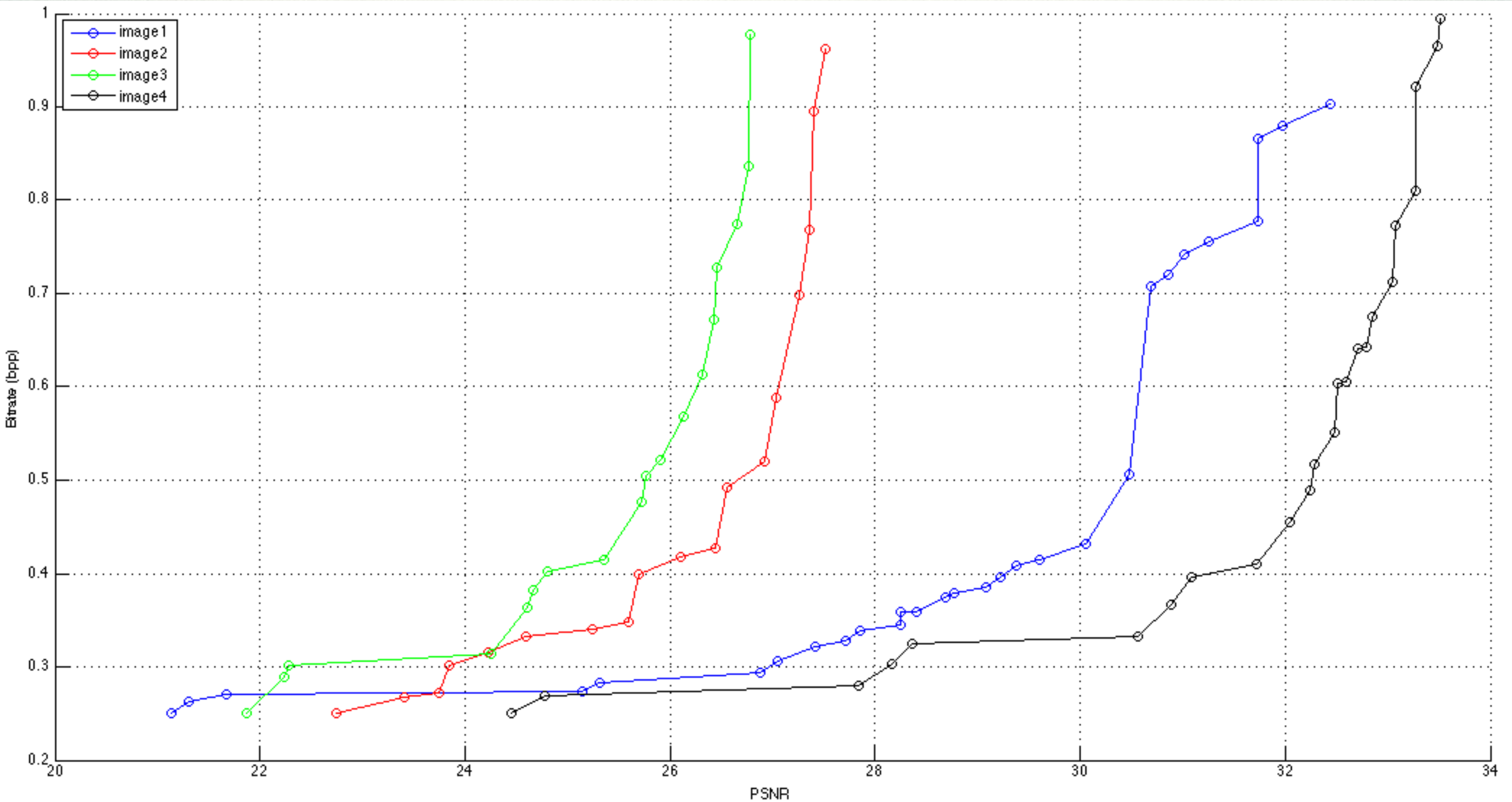

Iterator
Searching Space
parameter
Encoder
submit
ParameterPackage
PARs
dsr: width
dsr: height
mk: Y/U/V
predictorID
Q_res
parameter
bitrate
PSNR

BD curve: sample image

BD curve: sample image



BD curve: overall



More Detailed

- GitHub: https://github.com/HW-Lee/ImageCodec
- Ref paper: Simple Fast and Adaptive Lossless Image Compression Algorithm, Roman Starosolski http://sun.aei.polsl.pl/~rstaros/papers/s2006-spe-sfalic.pdf