Zoomable Video Playback on Mobile Devices by Selective Decoding

Feipeng Liu and Wei Tsang Ooi
National University of Singapore

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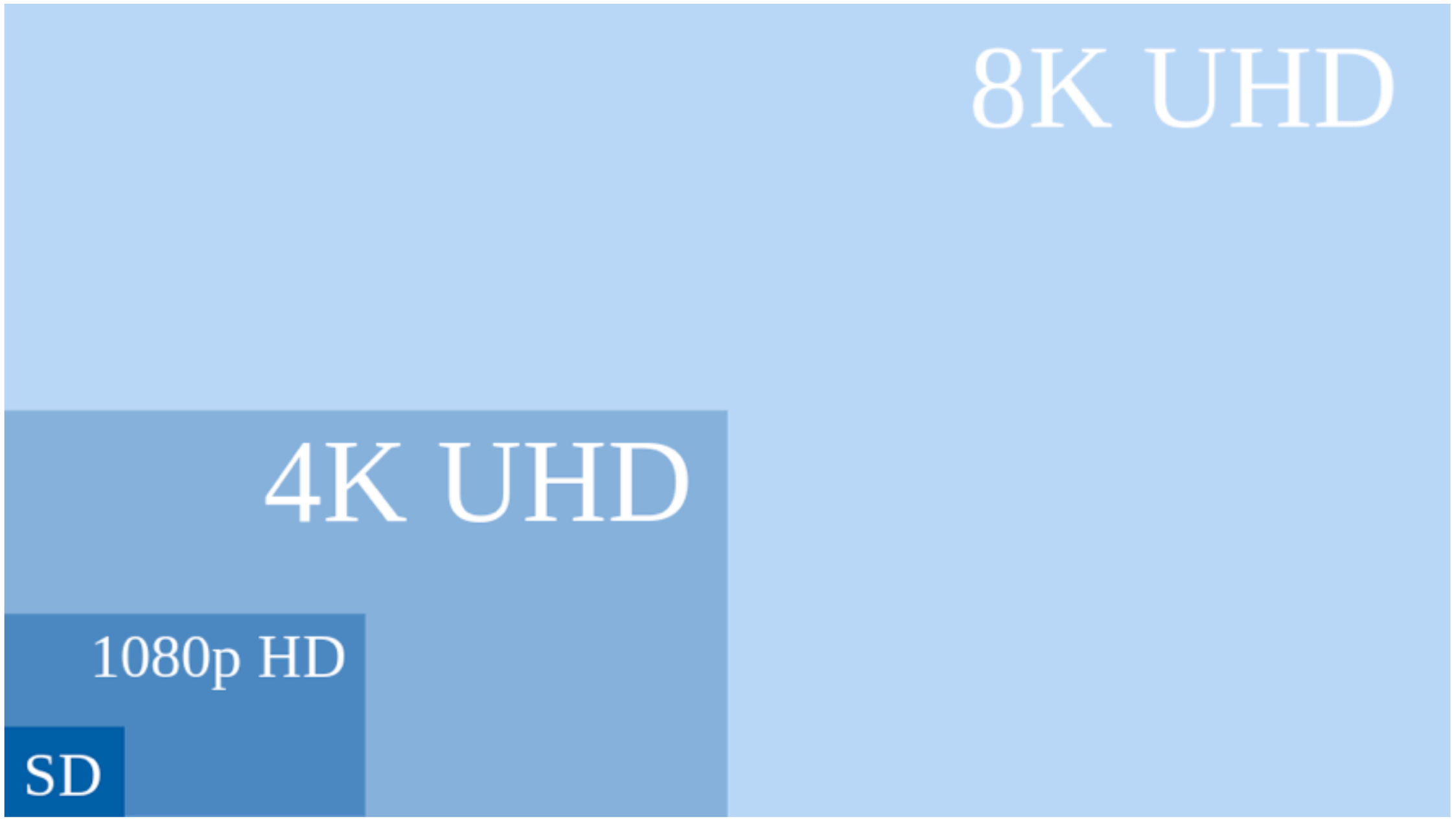

UHDTV Resolution Chart, from Wikipedia

bits captured

>

bits displayed


We want to zoom
and pan in videos,
just like in photos
and Web pages

Research Issues:

compression

streaming

interaction

:

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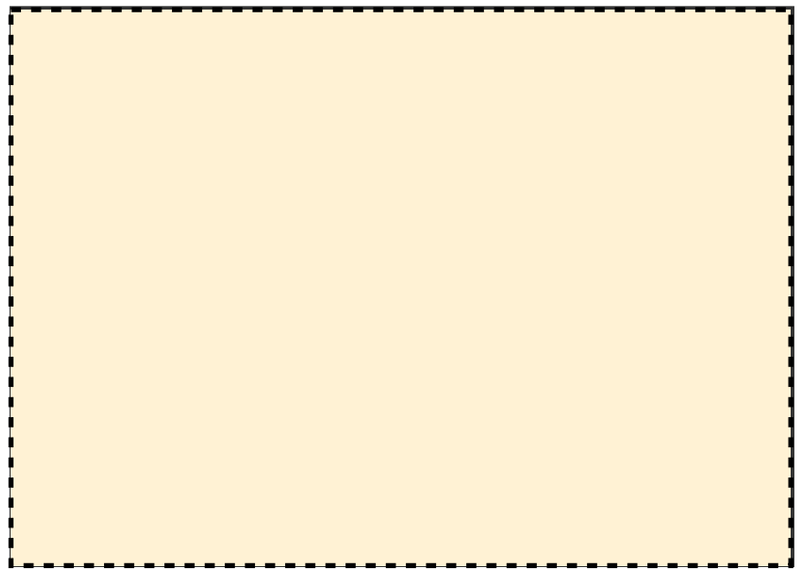
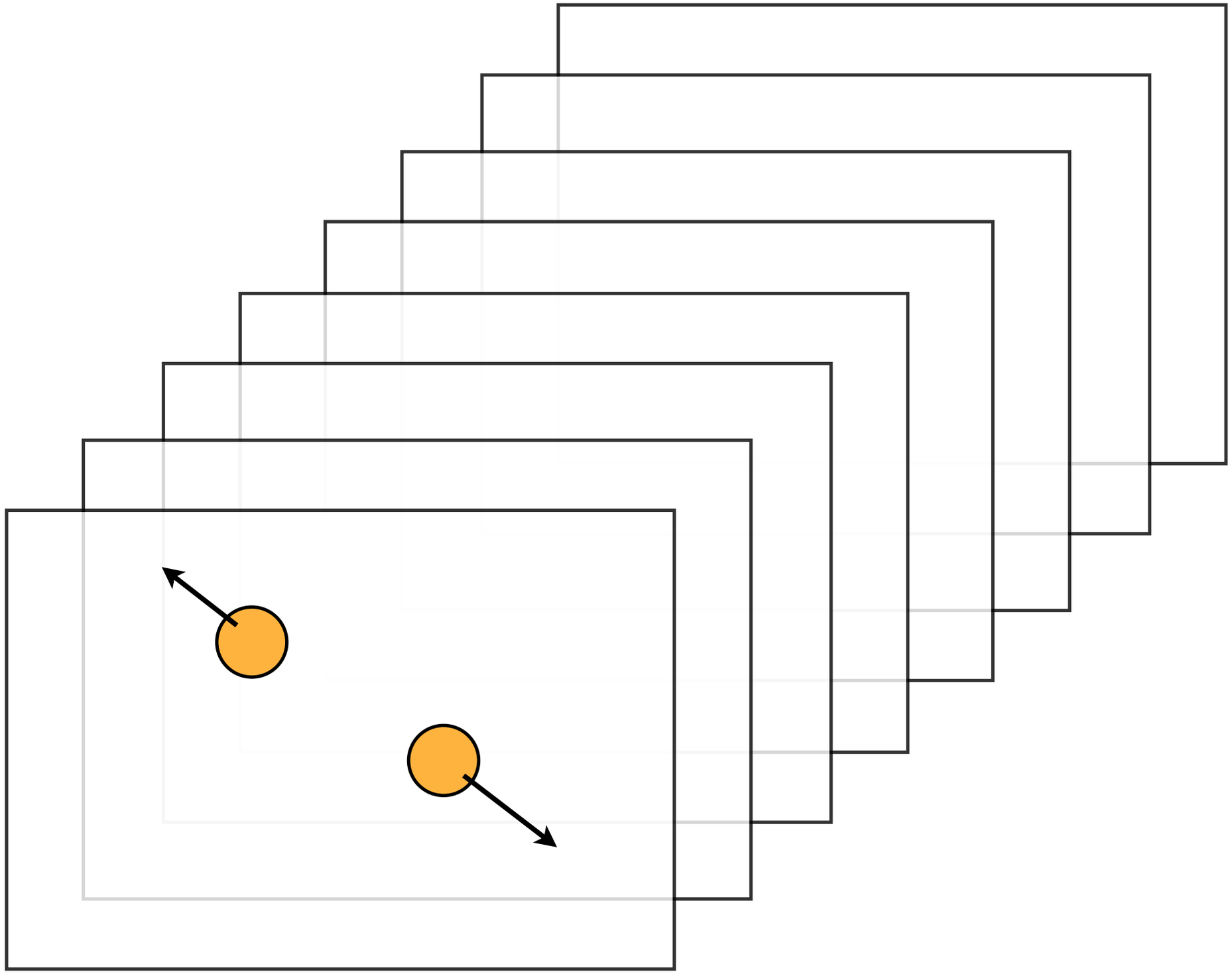
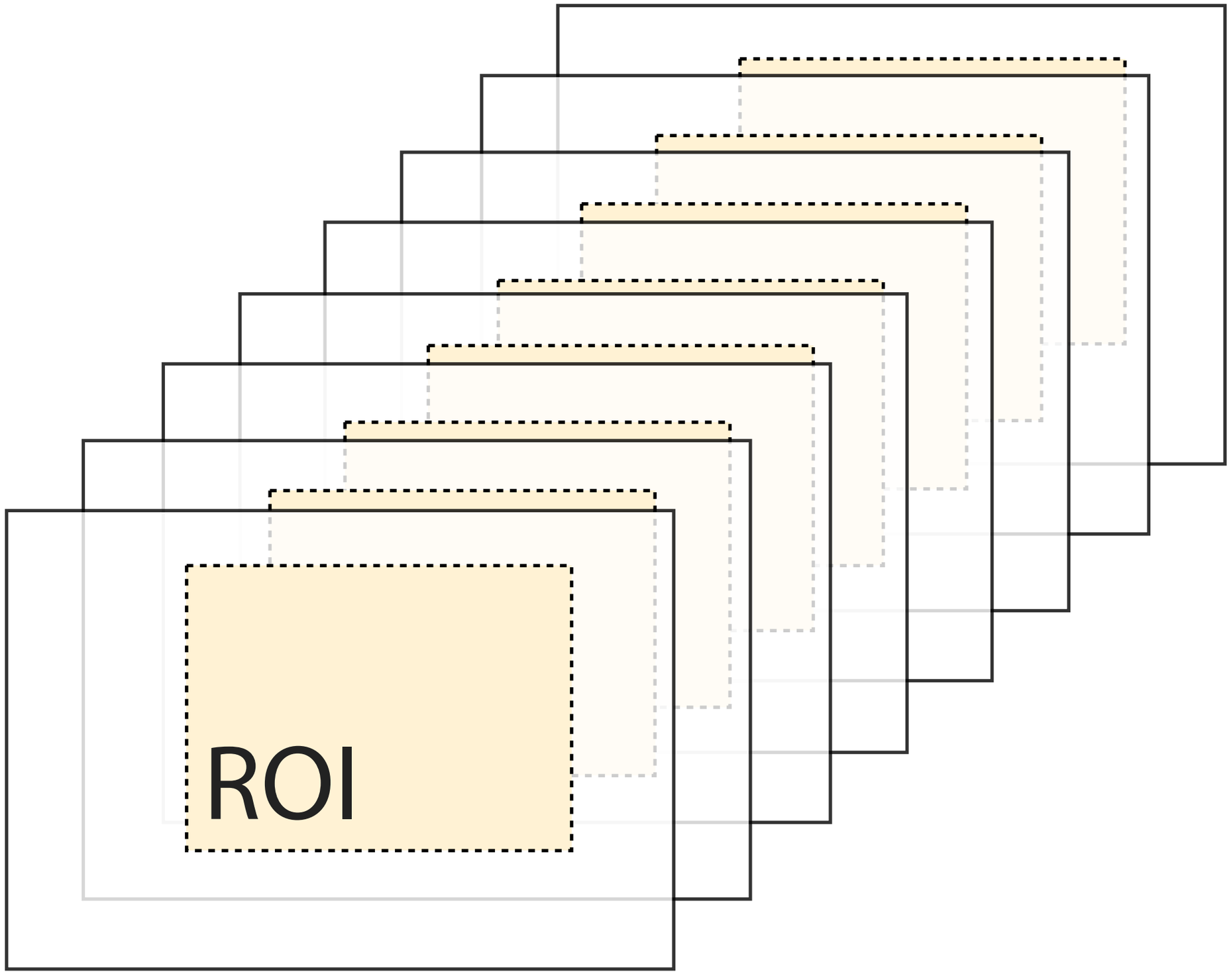
decode

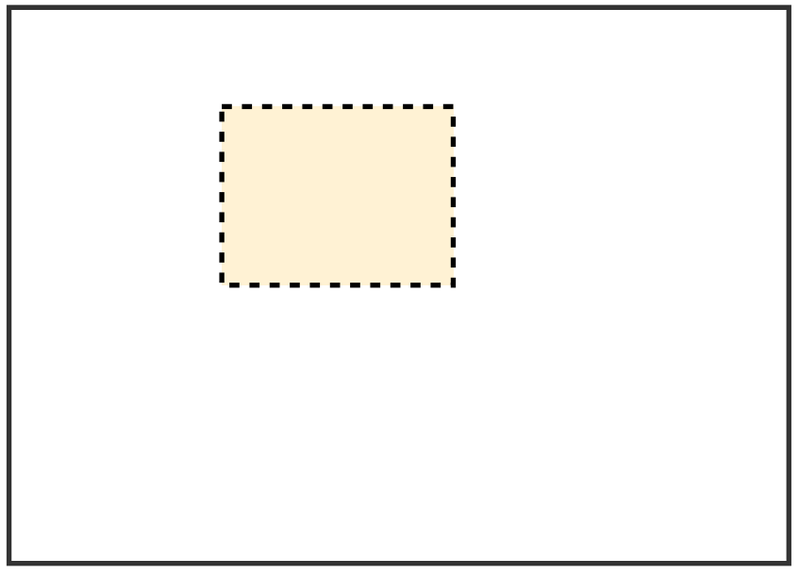


scale



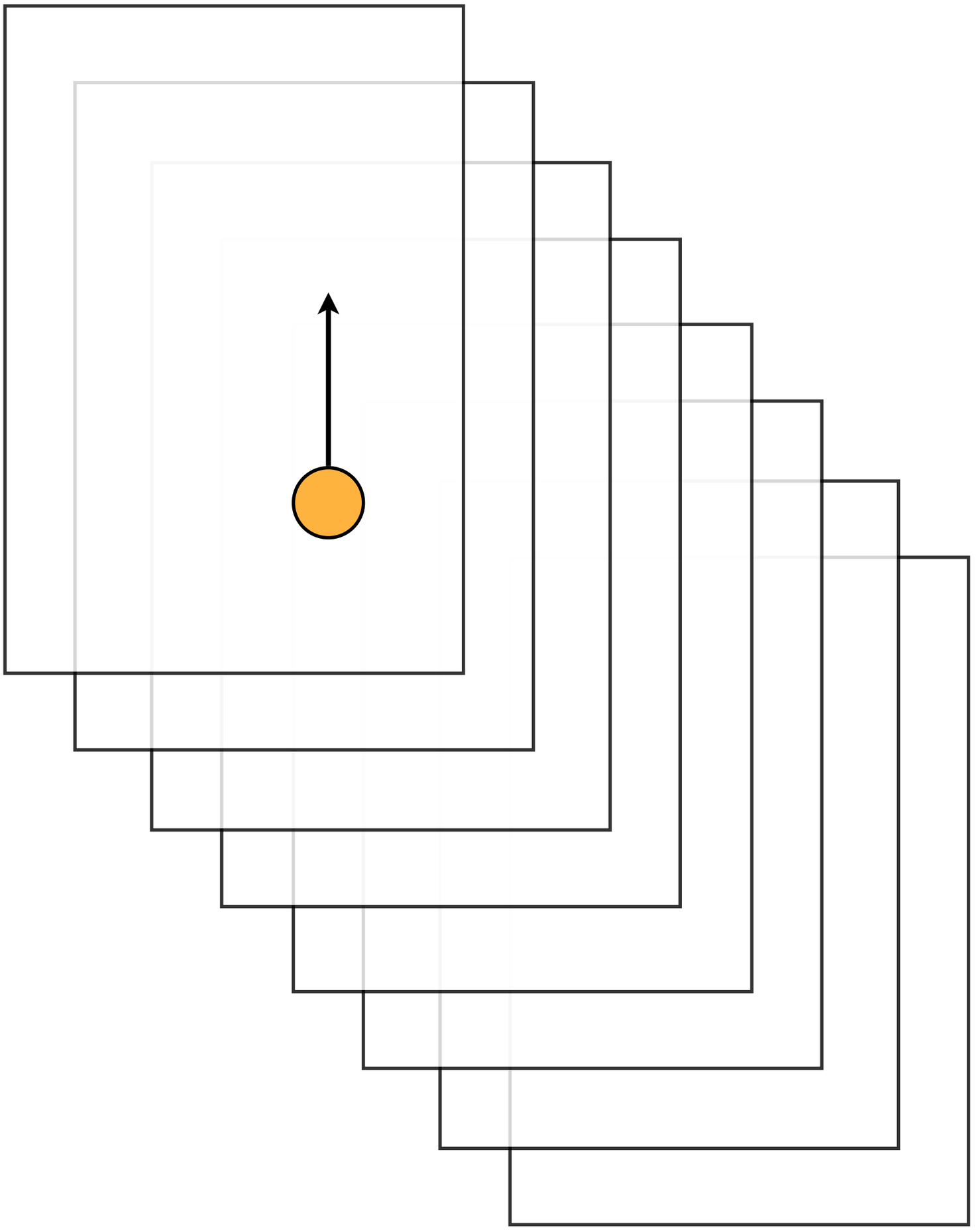

ROI

decode

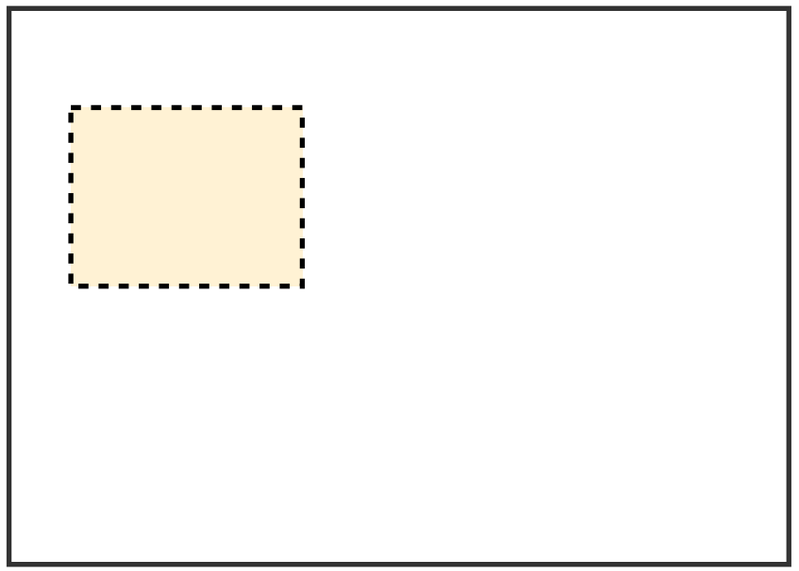


crop

scale



decode



crop

scale

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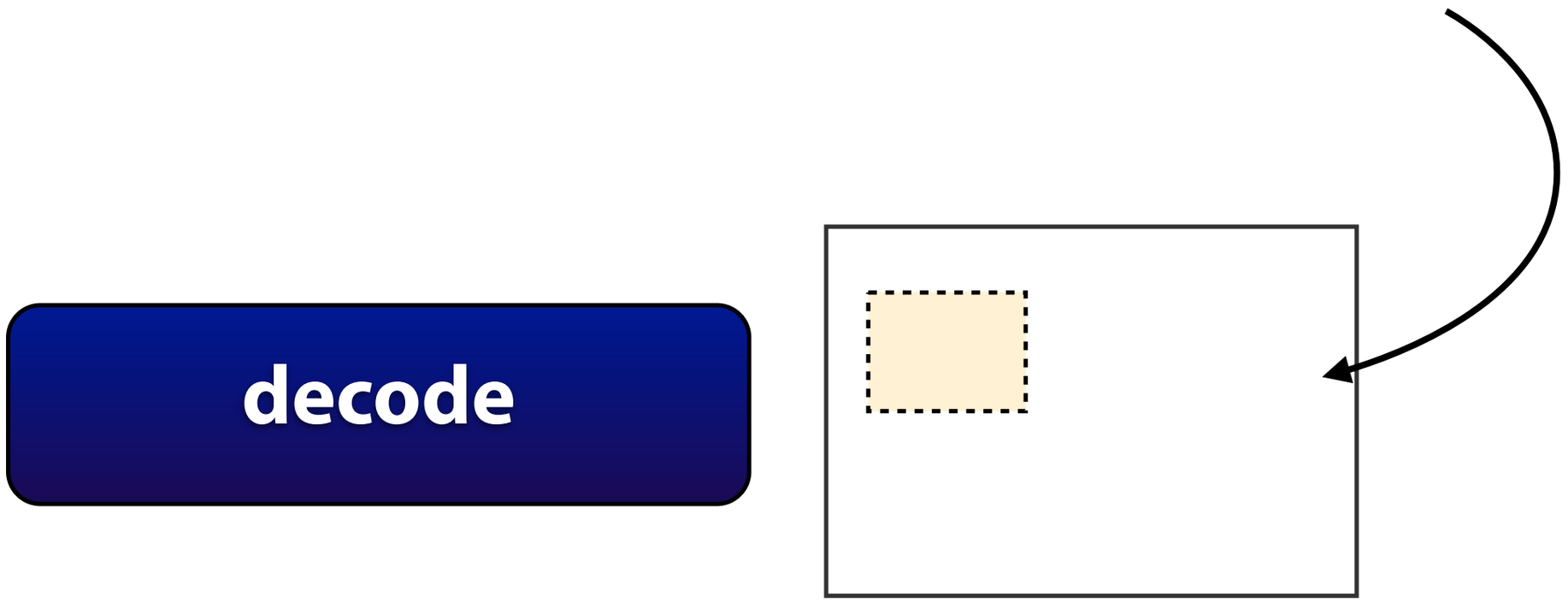
need to **save**
computation and power
as much as possible

not necessary to decode this area



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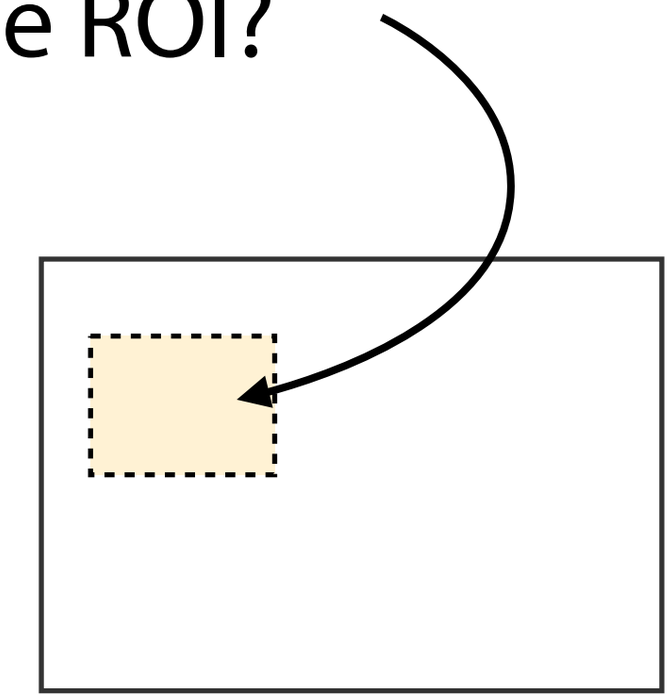
how to selectively decode the macroblocks in the ROI?

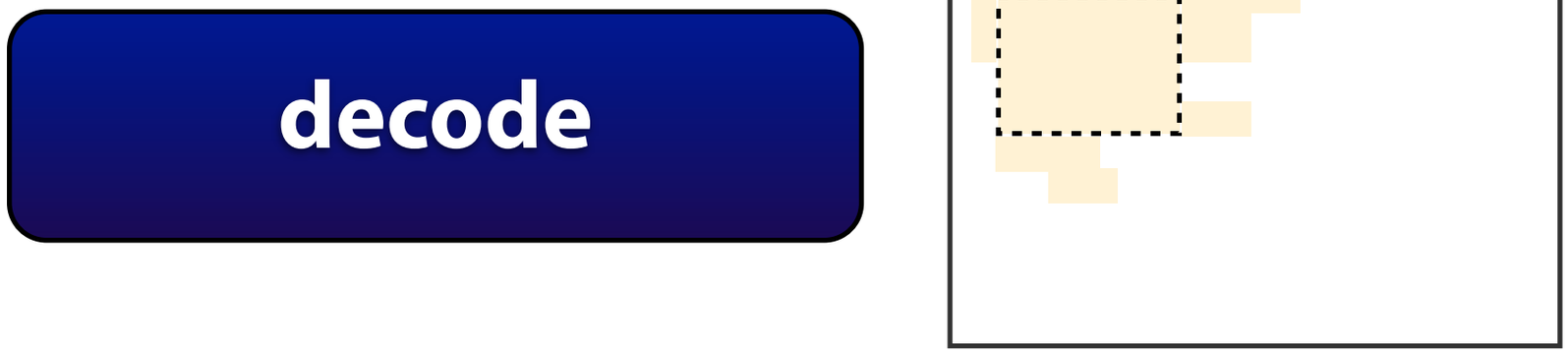


decode

crop

scale

need to decode the macroblocks of the region plus other macroblocks that it depends on



for each macroblock m

if m is in ROI **or**

m is needed by m' in ROI

(curr or future frames)

decode m

for each macroblock m

if m is in ROI **or**

m is needed by m' in ROI

(curr or future frames)

decode m

Questions:

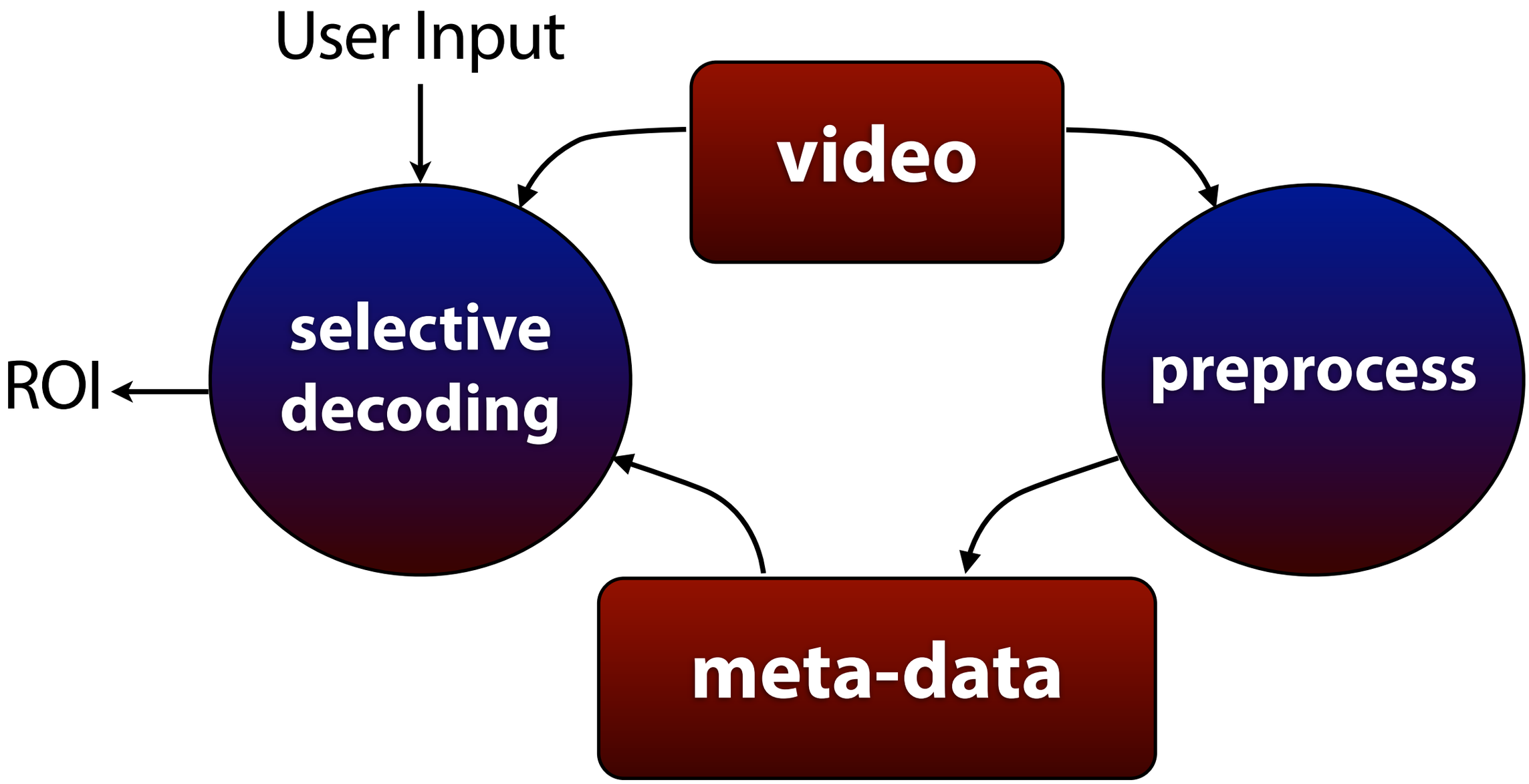
1. how to check if m is needed by m' in ROI?

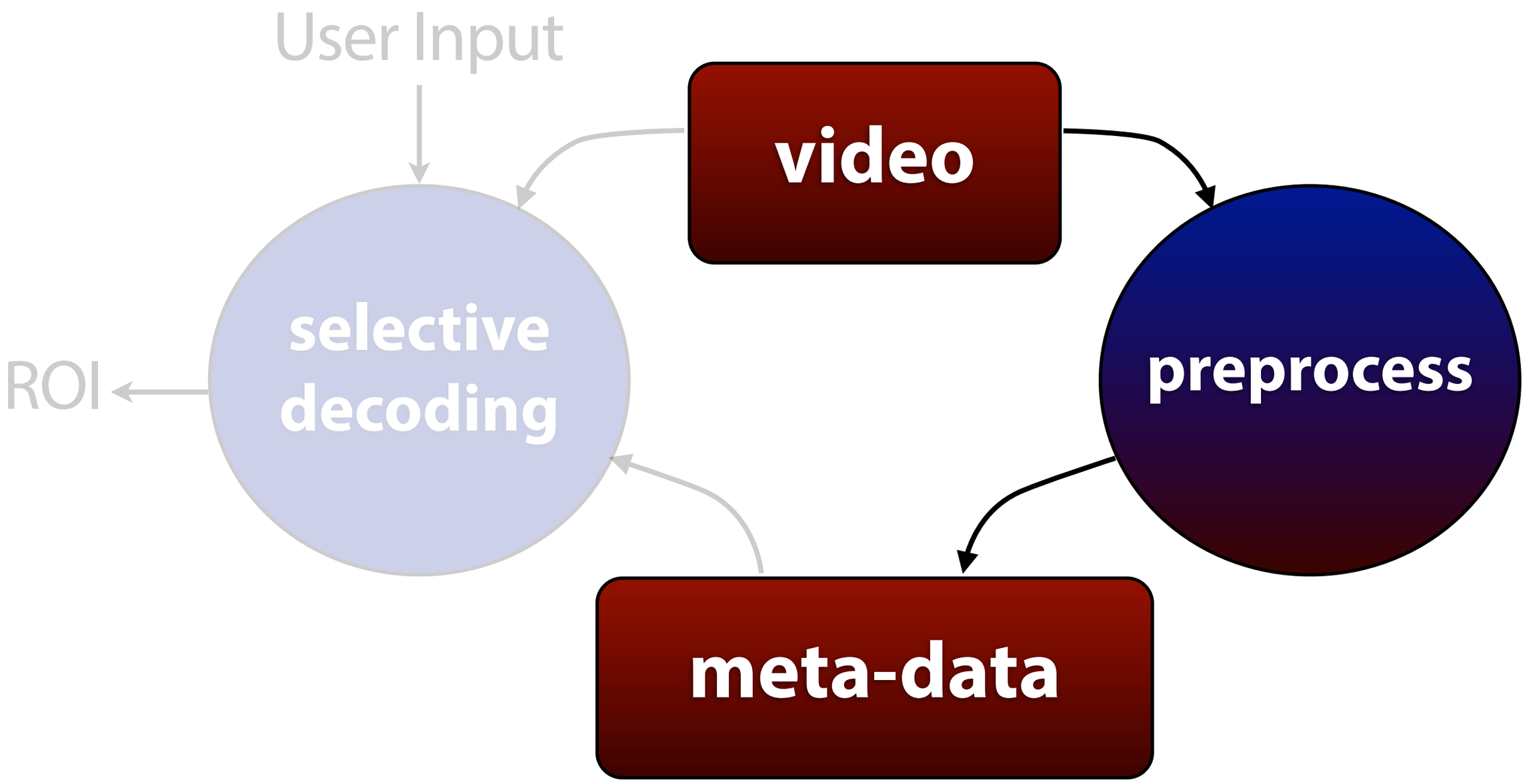
2. how to reduce the number of such m?

Requirements:

1. work with standard codec
2. no re-encoding of video

Our approach:




User Input
video
selective decoding
ROI
preprocess
meta-data

how it works with

MPEG-4 SP

(can be generalized
to other codec)

meta-data

=

MB

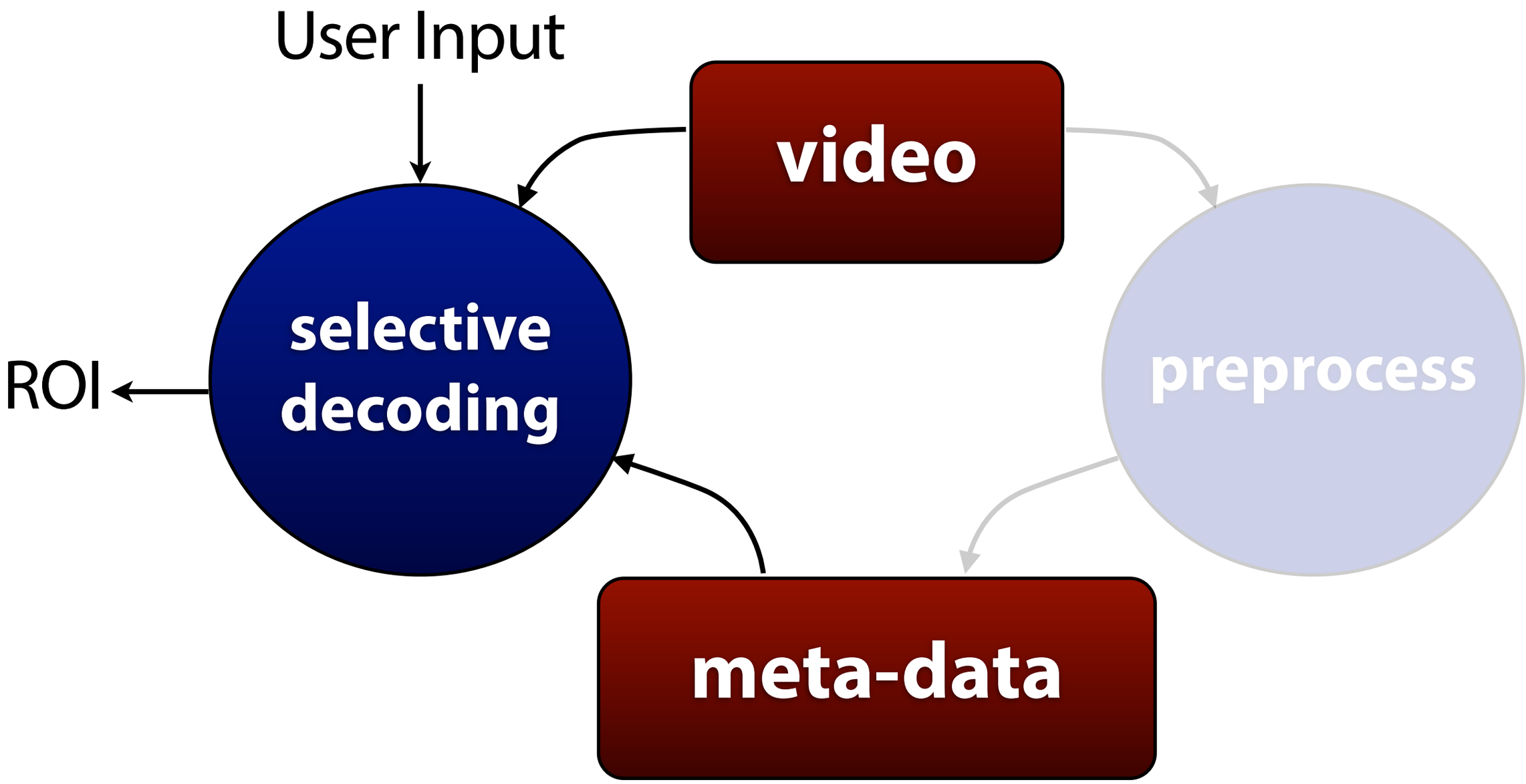
starting bit position

ending bit position

AC/DC prediction direction

MV values

Our approach:

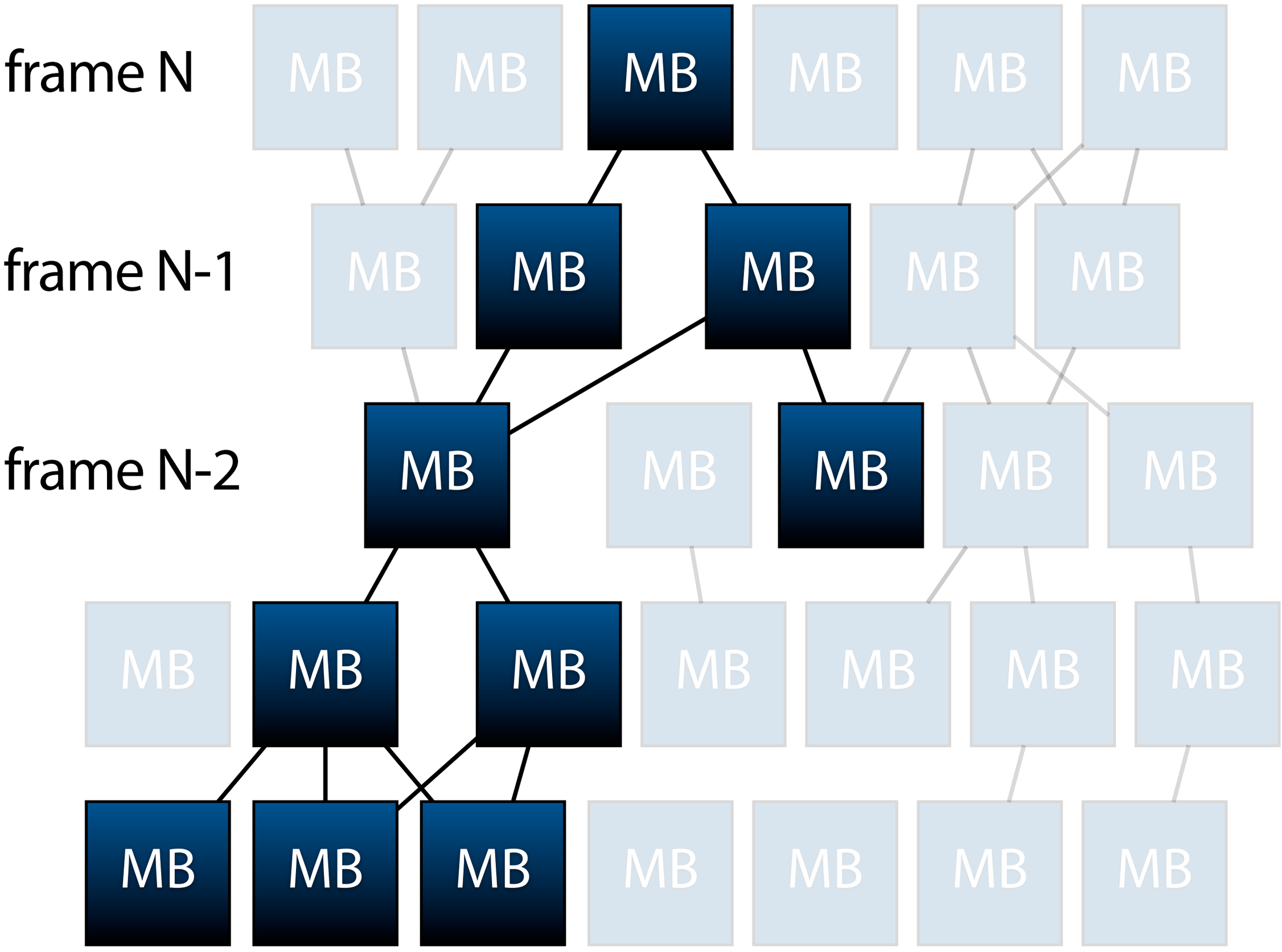


construct

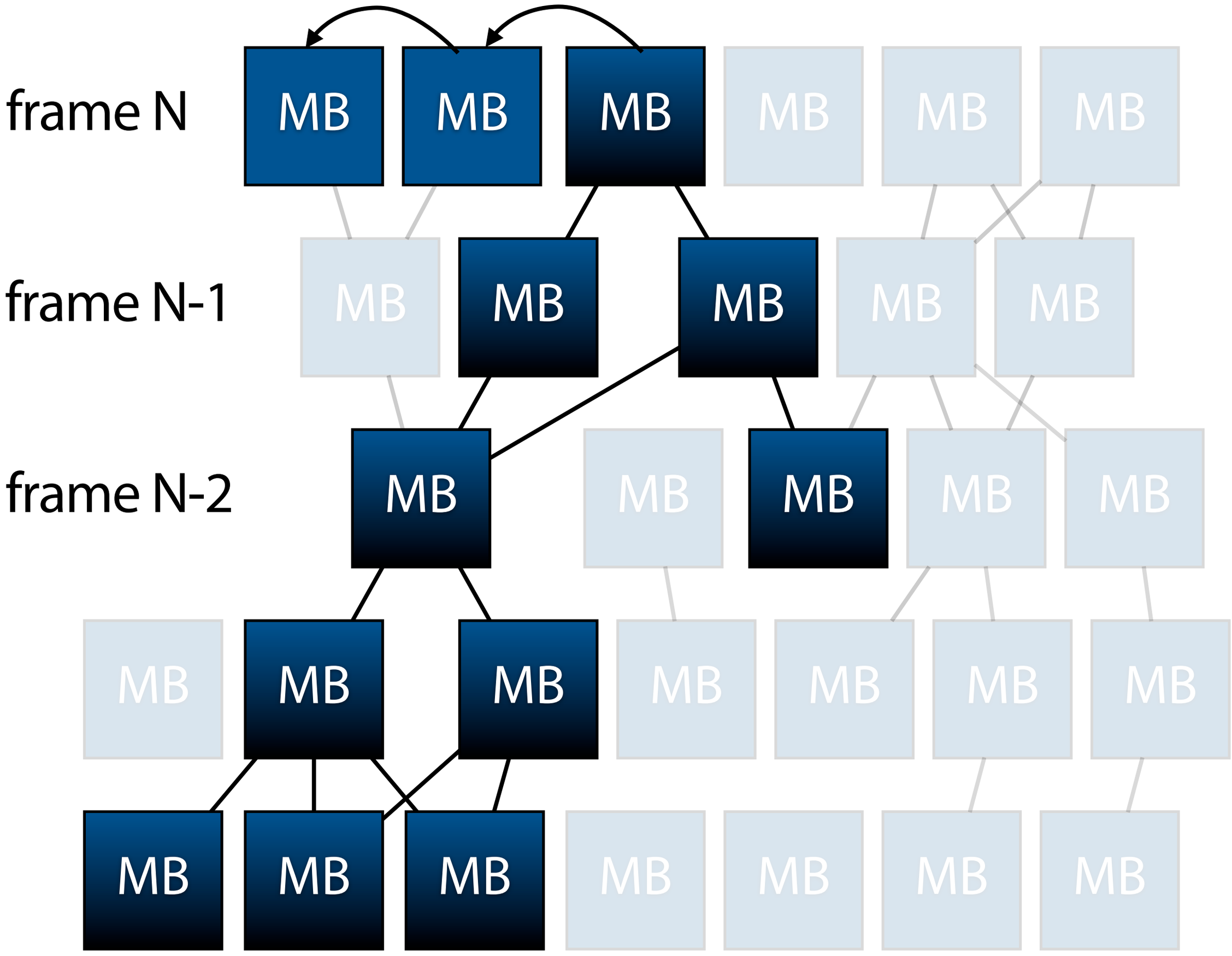
inter-frame

dependency graph

by tracing the motion vectors


frame N
frame N-1
frame N-2
MB

construct
intra-frame dependency graph
by tracing the AC/DC prediction directions


frame N
frame N-1
frame N-2
MB

Questions:

1. how to check if m is needed by m' in ROI?

Answer:

lookup the data structure

Questions:

2. how to reduce the amount of dependencies?

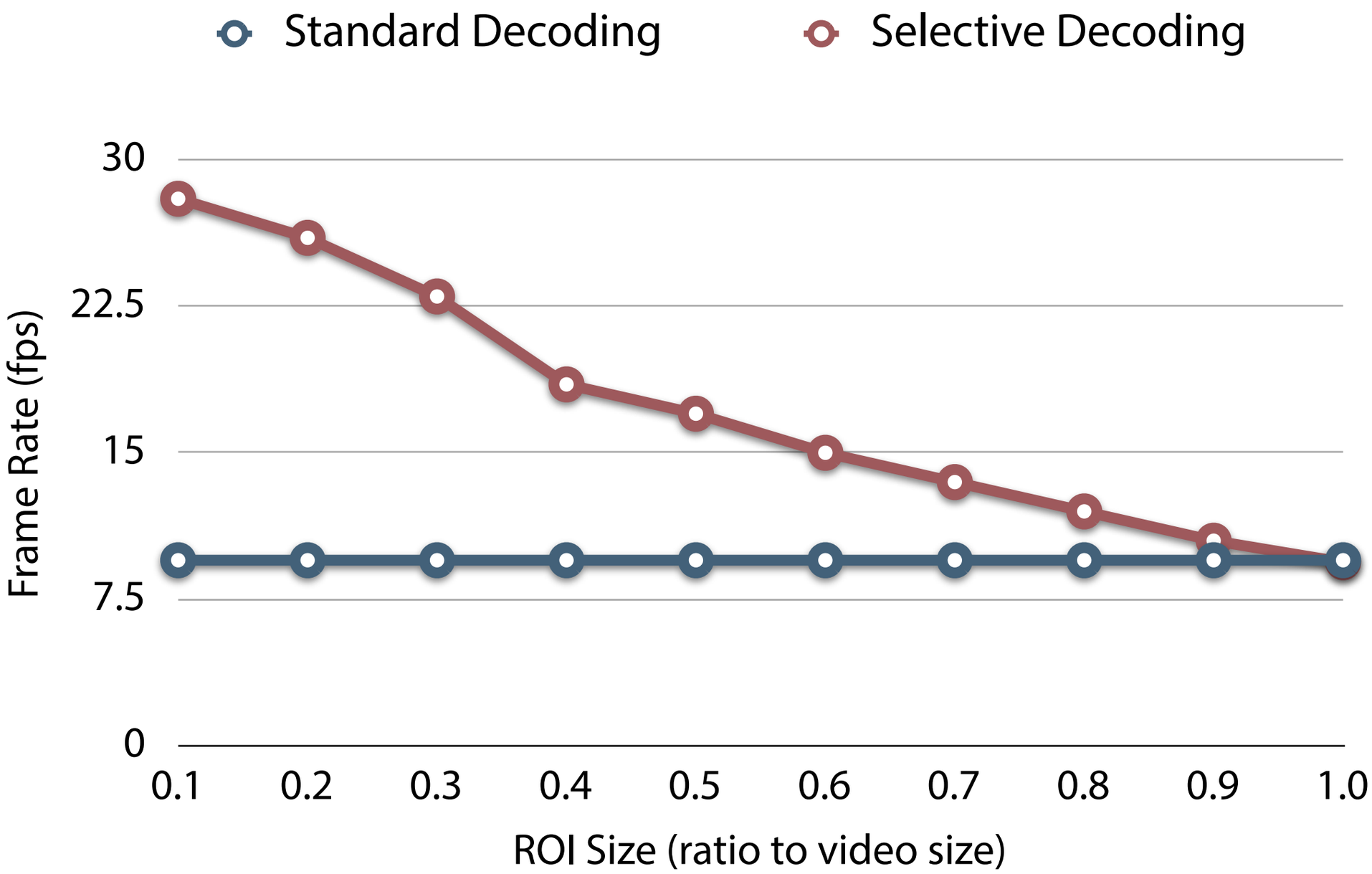
Answer:

storing AC/DC prediction directions and MV vectors

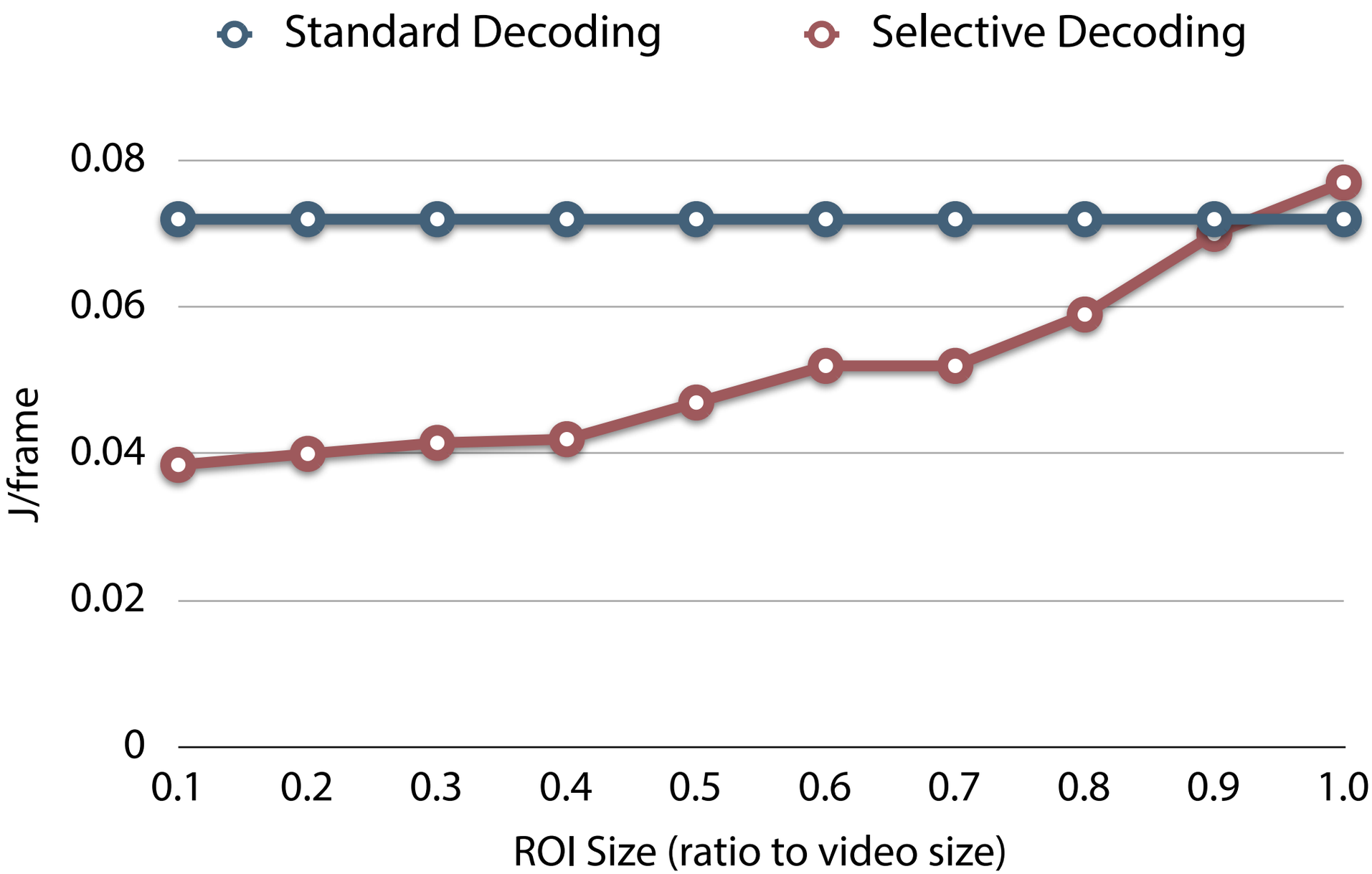
for each macroblock m
    if m is in ROI **or**
    m is needed by m' in ROI
    (curr or future frames)
        mark m for decoding

for each marked macroblock m
    seek to m
    decode and display m

Recall: aim to save computation and power as much as possible


Standard Decoding
Selective Decoding
30
22.5
15
7.5
0
Frame Rate (fps)
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
ROI Size (ratio to video size)

CPU power consumption (by PowerTutor)



at the cost of
huge meta-data file
(up to 5 times the video size)

This work is done as part of

www . **jiku** . org

A  Search Center Project