浙江大学计算机学院
数字媒体与网络技术

Digital Asset Management
数字媒体资源管理

2. Introduction to Digital Media Format

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Outline

- Image format and coding methods
- Audio format and coding methods
- Video format and coding methods
- Introduction to HTML and XML
- Graphics format and coding methods

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LZW Encode

"X X X D Z D D D Z D Z"

where the root values are X, D, Z. The following table follows the above encoding algorithm, showing the values of P, S and P + S (the pattern added to the dictionary) at the end of each iteration of the while loop, as well as the dictionary that is built up:

P	S	P + S	Output	Dictionary	
				Code	**Pattern**
				0	X
				1	D
				2	Z
	X	X			
X	X	XX	0	3	XX
X	X	XX			
XX	D	XXD	3	4	XXD
D	Z	DZ	1	5	DZ
Z	D	ZD	2	6	ZD
D	D	DD	1	7	DD
D	D	DD			
DD	Z	DDZ	7	8	DDZ
Z	D	ZD			
ZD	Z	ZDZ	6	9	ZDZ
Z		Z	2		

So the final output is:

"0 3 1 2 1 7 6 2"

And the input has been compressed from 11 symbols down to 8.

LZW Decode

"0 3 1 2 1 7 6 2"

The following follows the decoding algorithm, showing the necessary values for producing the decoded output:

P	C	LOOK_UP(P)	LOOK_UP(C)	Output	Dictionary	
					Code	**Pattern**
					0	X
					1	D
					2	Z
	0		X	X		
0	3	X	XX	XX	3	XX
3	1	XX	D	D	4	XXD
1	2	D	Z	Z	5	DZ
2	1	Z	D	D	6	ZD
1	7	D	DD	DD	7	DD
7	6	DD	ZD	ZD	8	DDZ
6	2	ZD	Z	Z	9	ZDZ

So the decoded output is:

"X X X D Z D D D Z D Z"

The grey rows show the situation where LOOK_UP(C) is output as soon as it is added to the dictionary, and it is added to the dictionary as

```
LOOK_UP(P) + 1st character of LOOK_UP(P)
```

This situation occurs when the algorithm comes across a code for C that is not in the dictionary. It is then deduced entirely from P as above, added to the dictionary, and then output. This case is caused in the encoding when the encoder outputs a code just after it was added to the dictionary.

2.3. Video formats and coding methods

Representations of video

- Sequence of images ?!?
  - Can be viewed as a 3-dimensional matrix
  - But it is only 50% correct
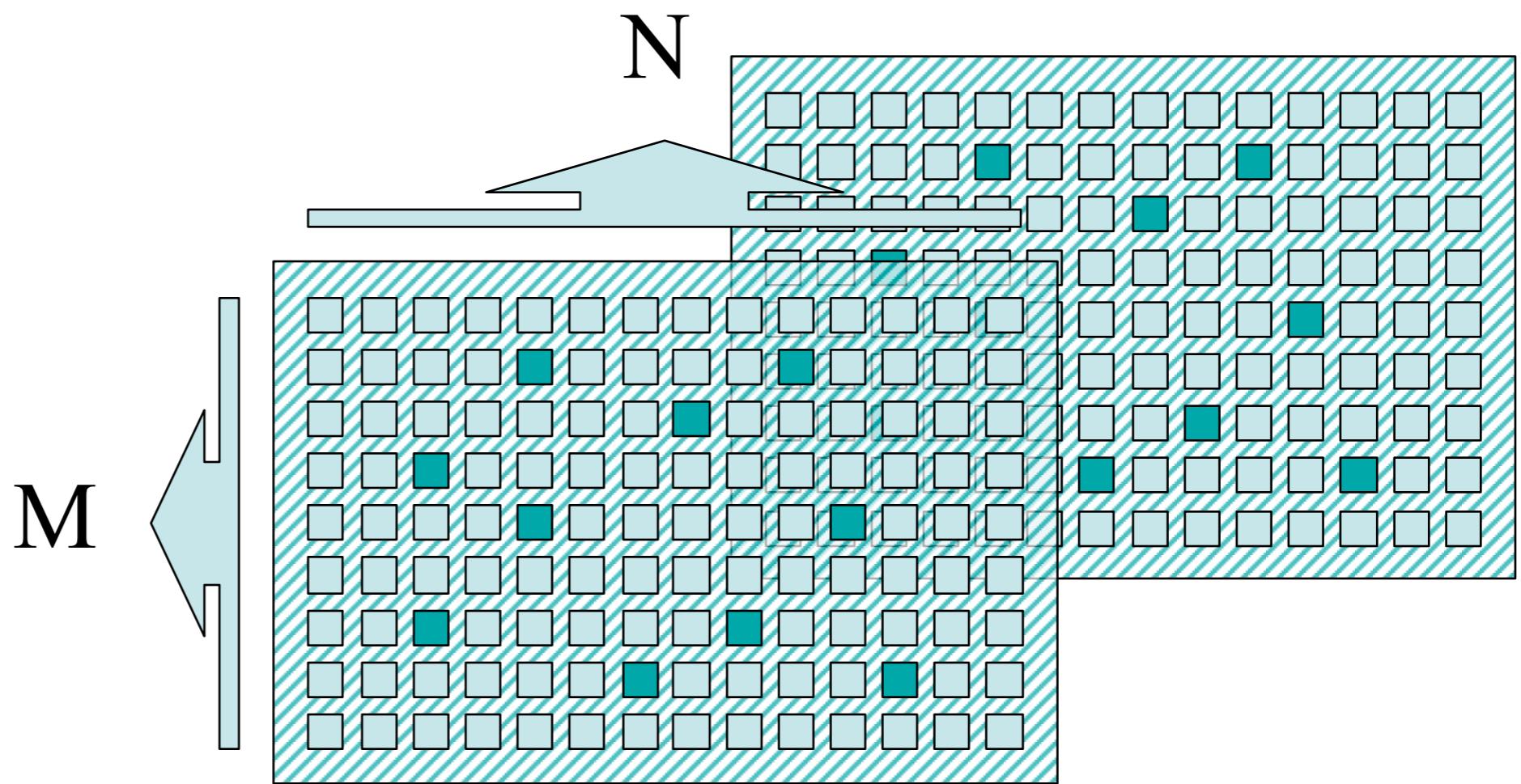
Common video formats

- AVI (Microsoft, Divx, …)
  - avi, wmv, asf
- RM (Realplayer)
  - rm, rmvb
- MOV (Quicktime)
  - mov
- MPEG
  - MPEG-1, MPEG-2, MPEG-4 …

http://www.bigbuckbunny.org/index.php/download/

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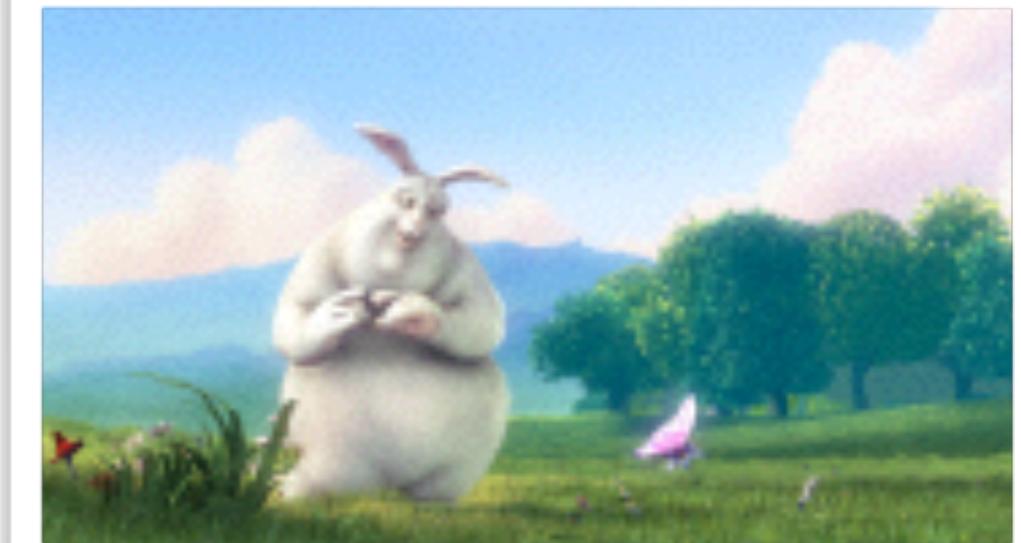
Video compression standards

- MPEG standards
  - Audio/Video compression, storage and play back standards
  - MPEG-1: VCD
  - MPEG-2: broadcast TV, e.g., DVD、HDTV etc.
  - MPEG-3: replaced by MPEG-2
  - MPEG-4: network video transfer，stream media
  - MPEG-7:
  - MPEG-21:

- ITU-T H.26x series

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MPEG-1 Standard ISO/IEC 11172-2 (1991)

"Coding of moving pictures and associated audio for digital storage media"

• **Video**

  – optimized for bit rates around 1.5 Mbit/s
  – originally optimized for SIF picture format,
  – but not limited to it:
    • [**NTSC based**] : 352x240 pixels at 30 frames/sec
    • [**PAL based**] :   352x288 pixels at 25 frames/sec

  – progressive frames only
    • no direct provision for interlaced video applications, such as broadcast television

MPEG-2 Standard ISO/IEC 13818-2 (1994)

- Video
  - 2-15 or 16-80 Mbit/s bit rate (target bit rate: 4…9 Mbit/sec)
  - TV and HDTV picture formats
  - Supports interlaced material

  - MPEG-2 consists of *profiles* (类) and *levels* （级）
    - Main Profile, Main Level (MP@ML)
      - 720x480 resolution video at 30 frames/sec
      - < 15 Mbit/sec (typical ~4 Mbit/sec)
      - for NTSC video

    - Main Profile, High Level (MP@HL)
      - 1920x1152 resolution video at 30 frames/sec
      - < 80 Mbit/sec (typical ~15 Mbit/sec)
      - HDTV

MPEG-1 v.s. MPEG-2

- MPEG-1 Apps ~
  - CD-I, digital multimedia,
 - video database, e.g. video-on-demand

- MPEG-2 Apps ~
  - satellite, cable, and terrestrial broadcasting,
  - digital networks, and
  - digital VCR

MPEG compression is based on 8 x 8 pixel **block processing**
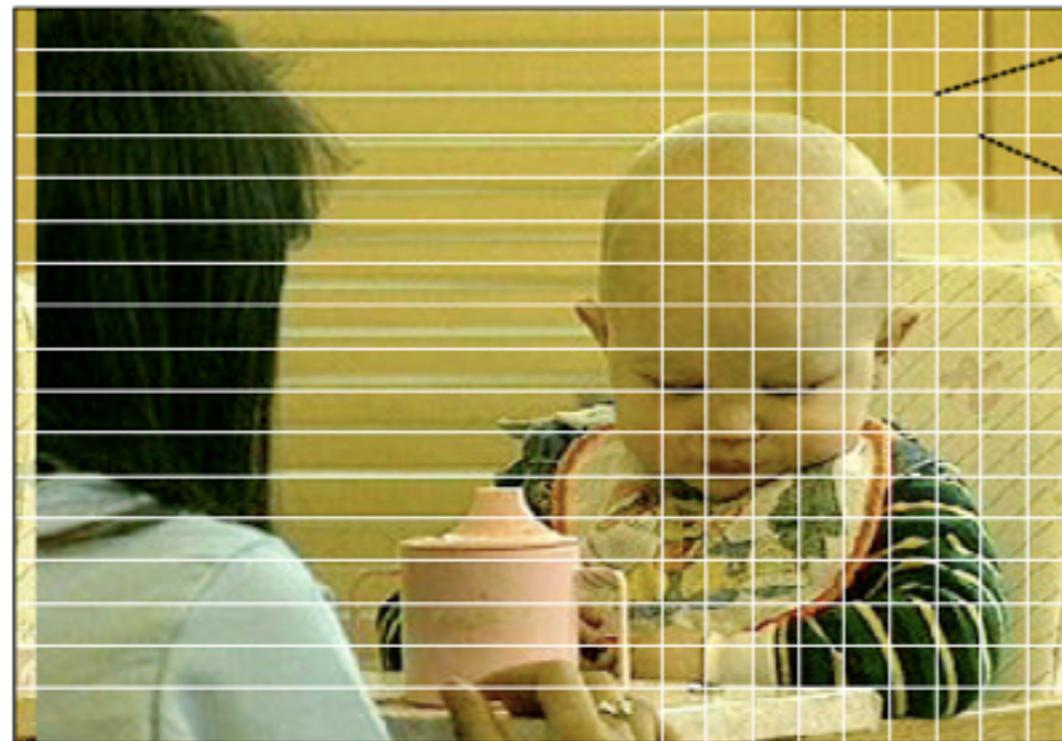
8 pixels

8 pixels

- 8 x 8 pixel block can be numerically manipulated by fast signal processor in real time

- Motion estimation is based on comparing the blocks between series of pictures

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MPEG: only compress moving parts

new picture

previous picture

difference

−

=

Encoder

Decoder

difference

previous picture

new picture

+

=

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MPEG: motion compression

I = Intra-Frame
P = Predicted frame
B = Bi-directionally interpolated frame

Bidirectional Interpolation

I B B P B B P

Prediction

Typical sequence: IBBPBBPBBI
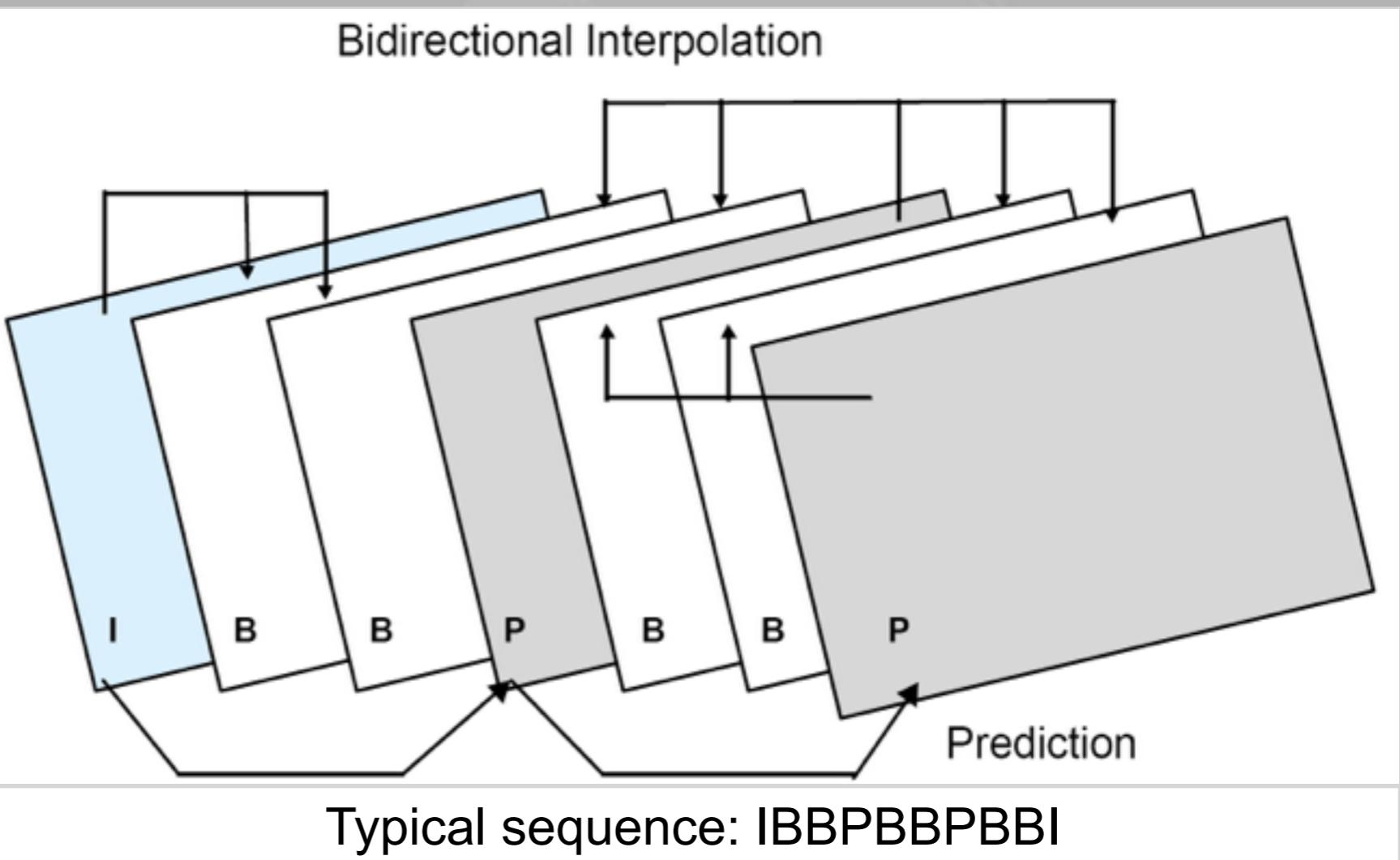
Video signal: stream of picture, it is not necessary to send every picture
- **Whole picture is needed only when all the content is changed!**
- **Several pictures has to be buffered to memory to make prediction forward and backward**

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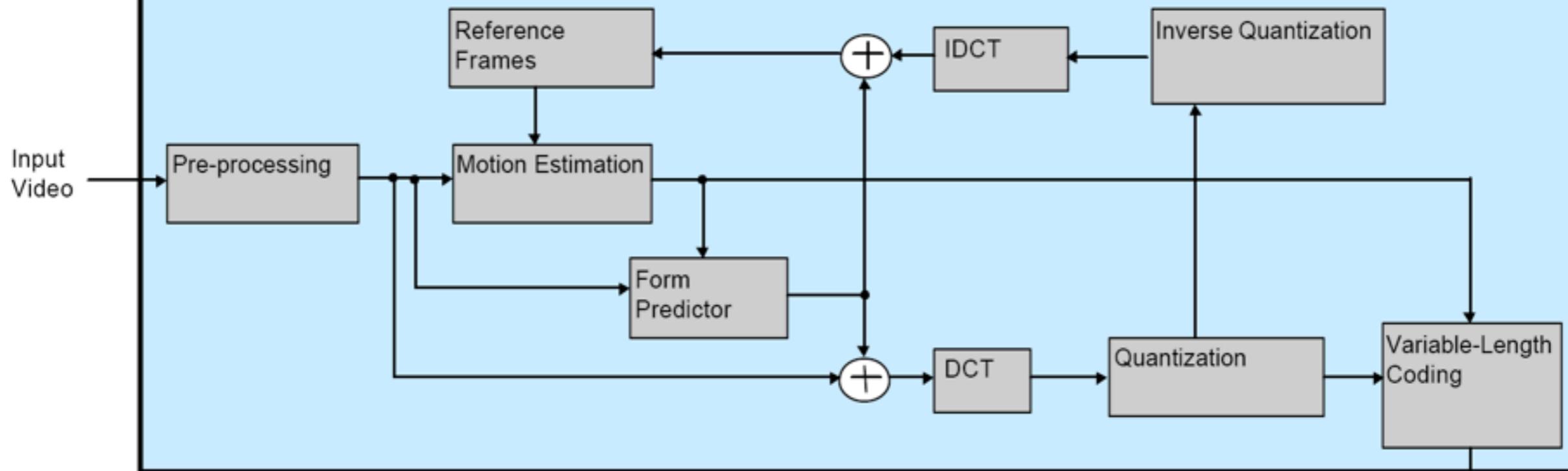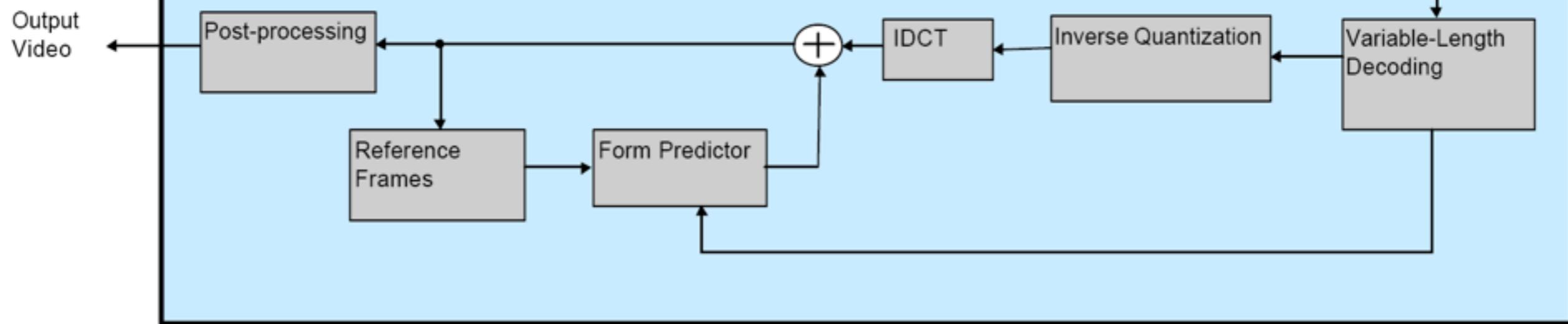
MPEG: other issues

- Motion compensating
- Intra-frame transfer order

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Color video coding

- 抽样和编码整个模拟（彩色）视频信号
  - 例如，复合编码

- 对亮度和色度分别编码
  - 例如，组件编码
  - 亮度比色度更重要，可根据应用场合采用4:2:2，4:2:0, 4:4:4等不同的编码比率

YUV 420等格式的说明

YUV444

YUV422

YUV420
MPEG-l

YUV420
MPEG-2

- YUV 的优点是色度通道的采样率可比 Y 亮度通道的低，同时不会明显降低视觉质量
- A:B:C表示法可用来描述 YUV 的采样频率比例
  - 4:4:4 每像素32位 表示色度频道没有下采样
  - 4:2:2 每像素16位 表示 2:1 的水平下采样，没有垂直下采样。对于每两个 U 样例或 V 样例，每个扫描行都包含四个 Y 样例
  - 4:2:0 每像素16位或12位 表示 2:1 的水平下采样，2:1 的垂直下采样
 - 4:1:1 表示 4:1 的水平下采样，没有垂直下采样。对于每个 U 样例或 V 样例，每个扫描行都包含四个 Y 样例，不太常用
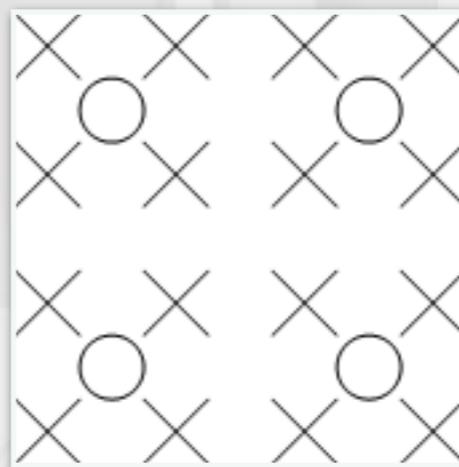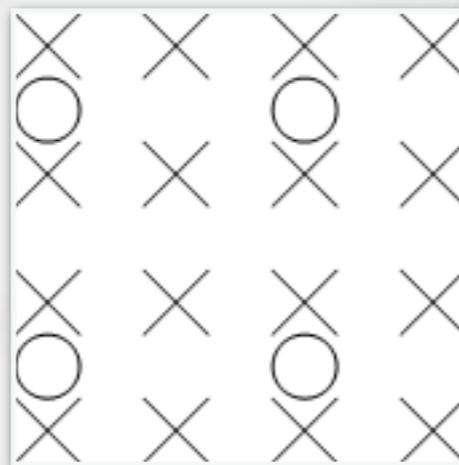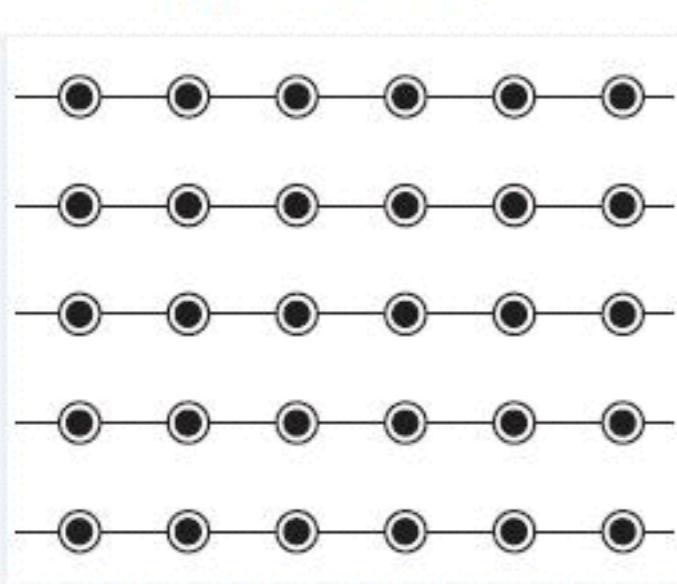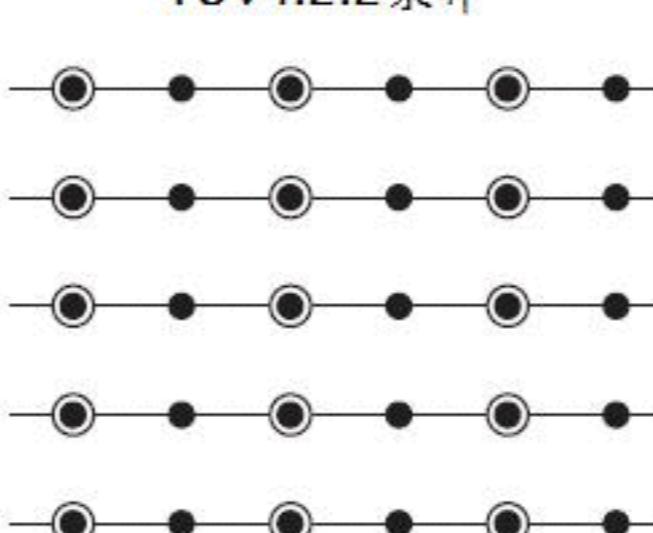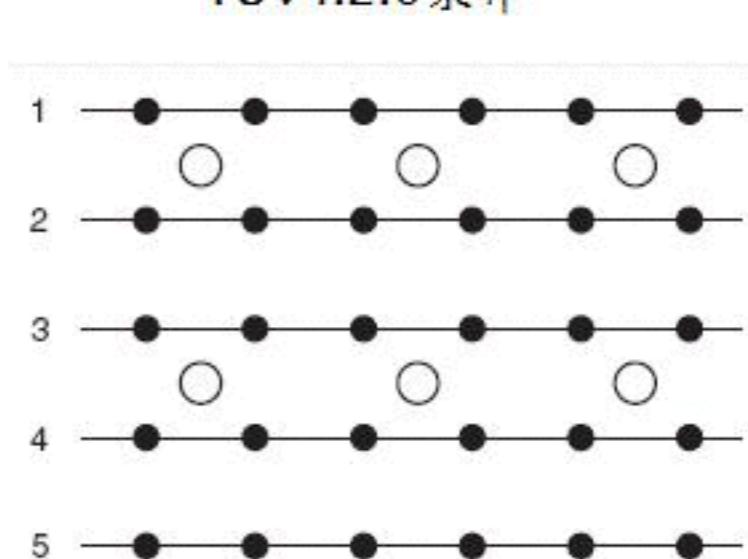
黑点表示采样该像素点的Y分量，以空心圆圈表示采用该像素点的UV分量

Overview of H.264

- JVT（Joint Video Team）
  - founded on December 2001, Pattaya Thailand.
  - video coding specialists from ITU-T and ISO, the two international standards organizations
  - goal: define a new video coding standards to achieve high compression rate, high image quality, good network adaptive coding frame.

- H.264: A new video compression standard
  - accepted by ITU-T
  - accepted by ISO
    - called AVC (Advanced Video Coding) standard
    - as the 10th part of MPEG-4

Major history of digital video standard

H.264 coding principle

ASTRI H.264 Baseline Profile Encoder Function Diagram
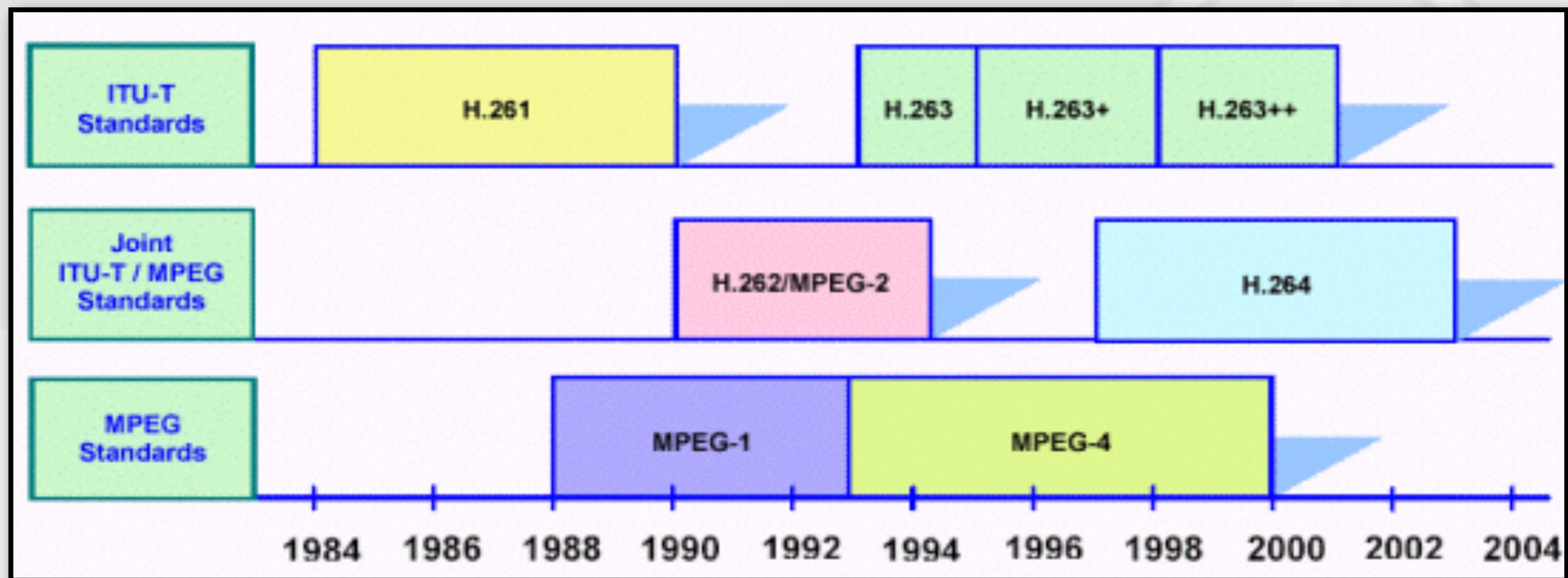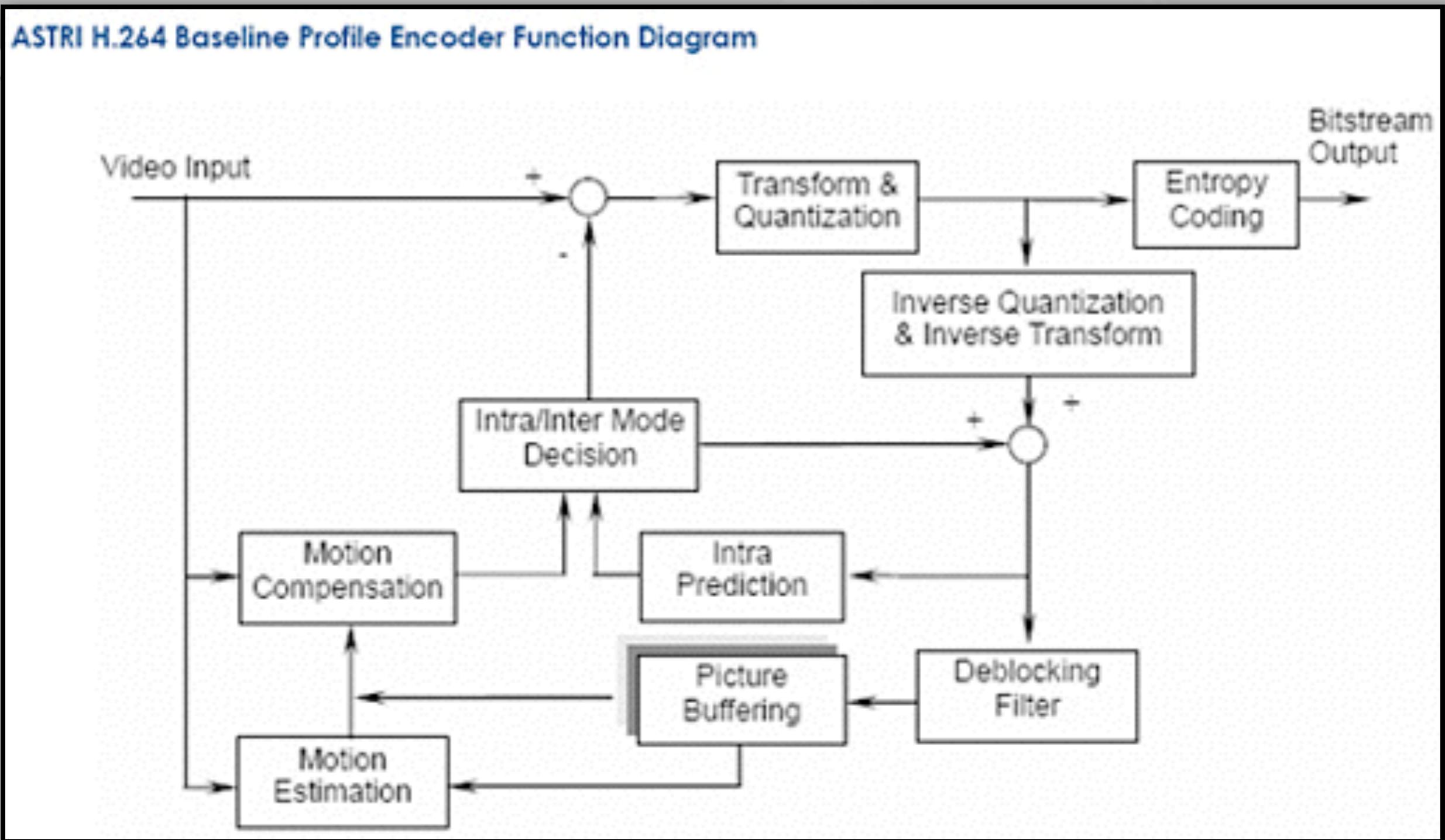
H.264的主要技术特点

1. 4类DCT整数变换以及相应的量化方法

2. 7种宏块预测模式
   - 16×16, 16×8, 8×16, 8×8, 8×4, 4×8, 4×4
   - 运动估计和补偿更加精确

3. 多参考帧
4. 帧内预测
5. 改进的去块效应滤波器（Deblocking filter）
6. 增强的熵编码方法
   - UVLC（Universal VLC）、CAVLC（Context adaptive VLC）和CABAC

7. 1/4像素插值
8. 宏块级逐行、隔行自适应编码MBAFF

Advantages and shortages of H.264

☑ High compression rate
- –In the same image quality, H.264 can be compressed as size of
  - 36% of MPEG-2，61% of MPEG-4，51% of H.263
- –Low bit stream, high quality

☑ High error correctness rate
- –H.264 provides necessary tools to solve the error coding problem in unstable network environments

☑ Network adaptation
- –H.264 provides Network Adaptation Layer so as to make files of H.264c can be easily transferred in different network environments.

☐ High computation price
- –In the same image quality, H.264 is twice of MPEG-2 in computation complexity.

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Applications of H.264

- H.264 standards added a NAL（Network Abstraction Layer）
  - to face the network connection and interface problem in the real applications.

- video communication
  - In real-time communication, POLYCOM、TANDBERG、VCON、SONY etc. claimed their own H.264 based TV-meeting products.

- digital TV broadcasting
  - MPEG has already finished defining the MPEG-2 compatible standard on H.264 stream coding content

- video storage-and-play-back
  - For High resolution DVD（HD DVD）application, H.264/MPEG-4 AVC solution.

Summary of video coding

- Resolution
- Coding rate
- Motion coding
- Transfer performance

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2.4. HTML and XML

结构化文档概览

Overview of HTML

- Hypertext Markup Language
  - Developed by Tim Berners-Lee
    - lightweight markup language vs. complex SGML.
  - Based on pure text format

  - Rich abilities to display multimedia information.
    - Later added tags to support image and videos.

  - HTML 3.2 => HTML 4.0 => HTML 5.0
    - Different browser has their own display effects.

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Overview of all HTML elements

Reference: http://htmlhelp.com/reference/wilbur/overview.html

Head →

Body →

```
<!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 4.01 Transitional//EN"
"http://www.w3.org/TR/html4/loose.dtd">
<html>
<head>
    <title>Apple中国</title>
    <meta http-equiv="content-type" content="text/html;
charset=gb2312">
    ...
</head>

<body>
<!-- Tag for Activity Group: General, Activity: Apple China -
Homepage -->
...
</body>
</html>
```

http://www.apple.com.cn/

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Overview of HTML - Head elements

```html
<!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 4.01 Transitional//EN" "http://www.w3.org/TR/html4/loose.dtd">
<html>
<head>
    <title>Apple中国</title>
    <meta http-equiv="content-type" content="text/html; charset=gb2312">
    ...
    <link rel="home" href="http://www.apple.com/">
    ...
    <script src="http://images.apple.com/global/scripts/lib/prototype.js" type="text/javascript" charset="utf-8">
    </script>
    ...

    <style type="text/css" media="all">
    ...
    #billboard { width: 1100px; margin: 0 auto 15px; overflow: hidden; position: relative; }
    #ticker { margin-bottom: 15px; }
    #homefooter { margin: 60px auto 50px; }
    ...
    </style>
</head>
```

- TITLE - Document title
- ISINDEX - Primitive search
- META - Meta-information

- LINK - Site structure
- BASE - Document location
- SCRIPT - Inline script
- STYLE - Style information

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Overview of HTML - Body elements

```
<html>
<head> ... </head>
<body>
    <H1> Hello, world </H1>
    <P> Digital Asset management is cool! </P>


</body>
</html>
```

- **Block level elements**

  –Headings: H1 => H6

  –Lists: UL, OL, DIR, MENU, LI, DL, DT, DD

  –Text Containers: P, PRE, BLOCKQUOTE, ADDRESS

  –others: DIV, CENTER, FORM, HR, TABLE

Overview of HTML - Body elements

```
<html>
<head> ... </head>
<body>
    <H1> Text-level elements </H1>
    <A href="http://www.google.com"> GOOGLE  <IMG src=" ... ">  </A>


</body>
</html>
```

- **Text-level elements**
  - –Logical markup: EM ...
  - –Special markup: A, IMG, APPLET ...
  - –Physical markup: B, ...
  - –Forms: INPUT ...
  - –Tables: CAPTION, TR, TH, TD

About CSS
叠样式表 (Cascading Style Sheets)

- http://www.w3school.com.cn/css/css_intro.asp

- 样式定义如何显示 HTML 元素
- 样式通常存储在样式表中（*.css）
- 把样式添加到 HTML 4.0 中，是为了解决内容与表现分离的问题
- 外部样式表可以极大提高工作效率
- 外部样式表通常存储在 CSS 文件中
- 多个样式定义可层叠为一个

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HTML 5.0

- 学习参考：http://www.w3school.com.cn/html5/index.asp
- 实例解释：http://directguo.com/html5
  - http://html5-slide-template.googlecode.com/svn/trunk/html5-slide-template.html#slide1

- 一套Web富客户端开发的工业标准
  - 许多新特性：内建的视频、音频标记，元素拖放功能
  - 最新的 Safari、Chrome、Firefox 以及 Opera 支持某些 HTML5 特性，Internet Explorer 也已经逐步支持

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HTML5

Taxonomy & Status on January 20, 2013

Legend:
- W3C Recommendation
- Proposed Recommendation
- Candidate Recommendation
- Last Call
- Working Draft
- Non-W3C Specifications
- Deprecated

HTML5 & related technologies

W3C HTML5 specification

Initial WHATWG HTML5 specification

CSS3

MathML 3.0 · SVG · Selectors L1 · Navigation Timing · Web Open Font · RDFa · Geo Location · Touch Events · Animation Timing · Device Orientation · Contacts API · Indexed Database · Media Capture · File API · XmlHTTP Request · WebGL · Calendar API · Messaging API · HTTP Caching

Web SQL · Web Storage · HTML + RDFa · Web Messaging · Canvas 2D · Web Sockets · Audio Video · HTML Markup · Drag and Drop · Web Workers · Micro data

by Sergey Mavrody (cc) BY · SA

About JavaScript

- http://www.cad.zju.edu.cn/home/zhx/DAM/2015/doku.php?id=js

- JavaScript

About Python

- http://www.cad.zju.edu.cn/home/zhx/DAM/2015/doku.php?id=python
- 网页服务：
  - Flask …
- 科学计算：
  - numpy and scipy …
- 图像处理：
  - Image and opencv …
- 还有很多其他库：
  - virtualenv 构建虚拟环境
  - pip 安装python扩展包
  - …

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举个栗子

- HTML逆向解析——我的实验微信公众号:

- 欢迎关注、实验

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