COMMITTEE T1
CONTRIBUTION

Document Number T1A1.5/92-157

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STANDARDS PROJECT: Analog Interface Performance Specifications for Digital Video Teleconferencing/Video Telephony Service

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TITLE: NTIA Video Quality Algorithms Reference Tape Log

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ISSUE ADDRESSED: Video Quality

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SOURCE: NTIA/ITS - Arthur Webster

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DISTRIBUTION TO: T1A1.5

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KEYWORDS: Video Teleconferencing, Video Telephony, Video Quality, Subjective Quality, Objective Quality

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DISCLAIMER:

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NTIA Video Quality Algorithms Reference Tape Log
September 11, 1992

Reference Tape for NTIA/ITS video quality algorithms.

0. Introduction

NTIA/ITS (The National Telecommunication and Information Administration/ Institute for Telecommunication Sciences) is providing three copies of a reference tape and accompanying data to the T1A1.5 committee. These reference tapes and accompanying data may be used to assure that other laboratories' implementations of the NTIA/ITS video quality algorithms (given in T1A1.5/92-112) are the same as the NTIA/ITS implementation.

Any questions regarding the tape or accompanying data should be directed to:

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1.

The tape is in BetaCam SP format.
Tape Log:
Time codes h:mm:ss:[ff]

0:00:00[00]	0:01:00[00]	Color Bars
0:01:00[00]	0:02:00[00]	Box Defining Processing Region
0:02:00[00]	0:03:00[00]	NTIA Logo
0:03:00[00]	0:03:09[04]	5row2 - Source
0:03:10[00]	0:03:19[04]	5row2 - Degradation 9 - Codec A, 1.536 Mb/s with bit error rate of 10.E-5
0:03:20[00]	0:03:29[04]	5row2 - Degradation 14 - Codec B, 56 Kb/s
0:03:30[00]	0:03:39[04]	5row2 - Degradation 23 - Codec D, 45 Mb/s
0:03:40[00]	0:03:49[04]	vtc1nw - Source
0:03:50[00]	0:03:59[04]	start - Source

("5row2", "vtc1nw", and "start" are the names of test scenes)

2. Box Defining Processing Region

This box (Black = 16, White = 235) defines the subregion and A/D levels of the video over which calculations were performed. All video frames were sampled at 4*fsc (four times subcarrier).

This subregion approximates the displayed portion of the NTSC video signal. A subregion smaller than the active portion of the NTSC video was used to avoid unwanted edge effects that could occur with video that has been truncated by the hypothetical reference circuit (i.e. the video system).

3. Time alignment of video sequences.
The following time codes will provide time-aligned video.

Degradation 0
start_tc 0:03:00[02]
stop_tc 0:03:09[02]

Degradation 1
start_tc 0:03:00[02]
stop_tc 0:03:09[02]

Degradation 9
start_tc 0:03:10[01]
stop_tc 0:03:19[01]

Degradation 14
start_tc 0:03:20[02]
stop_tc 0:03:29[02]

Degradation 23
start_tc 0:03:30[01]
stop_tc 0:03:39[01]

4. Contents of floppy disk

Data is provided for the 9 second video sequences given by the above time codes (see item 3 above), with video frame number 1 being the video frame at the start_tc time code.

5row2 Source (Degradation 0)
5row2 Degradation 1 (Null degradation is a second grab of the source)
5row2 Degradation 9
5row2 Degradation 14
5row2 Degradation 23

Time histories (ASCII format, 1 value per frame) of the mean and standard deviation of:

1. S[F(n)], the Sobel filtered luminance (Y) image at frame number = n.
   [data files ov4_00.dat & dv4_##.dat]

2. DeltaF(n) = [F(n)-F(n-1)].
   where F(n) is a single luminance (Y) video frame at frame number = n.
   [data files ov21_00.dat & dv19_##.dat]

Each line in a data file contains the mean and standard deviation (in that order) of the given feature for a single frame of video.

The filenames are:

ov4_00.dat	Feature S	Degradation 0	(Source)
ov21_00.dat	Feature DeltaF	Degradation 0	(Source)
dv4_01.dat	Feature S	Degradation 1	(Null)
dv19_01.dat	Feature DeltaF	Degradation 1	(Null)
dv4_09.dat	Feature S	Degradation 9	(1.536 Mb/s)
dv19_09.dat	Feature DeltaF	Degradation 9	(1.536 Mb/s)
dv4_14.dat	Feature S	Degradation 14	(56 Kb/s)
dv19_14.dat	Feature DeltaF	Degradation 14	(56 Kb/s)
dv4_23.dat	Feature S	Degradation 0	(45 Mb/s)
dv19_23.dat	Feature DeltaF	Degradation 0	(45 Mb/s)

5. m1, m2, m3, from Contribution T1A1.5/92- 112 can be calculated from these data with the following equations:

Equations:

STDs	Standard Deviation over space (all pixels in a single frame)
STDt	Standard Deviation over time (all values in a time history)
RMSs	Root Mean Square over space (all pixels in a single frame) (sqrt(mean**2 + std**2))
RMSt	Root Mean Square over time (all values in a time history) (sqrt(mean**2 + std**2))
ABS	Absolute value.
FILTER	Peak Enhancing filter: Convolve with kernel=[-1 2 -1]
MAX	Maximum between the following two values e.g. MAX(a,b)
MAXt	Maximum over time history
ALOG10	Base 10 Logarithm.
q	estimated quality
m1,m2,m3	parameters
SO	Sobel of Original Source Video
SD	Sobel of Degraded Video
DeltaO	[O(n) - O(n-1)] where O(n) is 1 frame of Source Video at Frame=n
DeltaD	[D(n) - D(n-1)] where D(n) is 1 frame of Degraded Video at Frame=n
SI	Spatial Information Measure
TI	Temporal Information Measure

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q = 4.7485 -.9553*m1 -.3331*m2 -.3341*m3

m1 = RMSt (5.78 * ABS( (STDs(SO) - STDs(SD))/(STDs(SO)) ) )

m2 = STDt (FILTER{ .0934*MAX[ (RMSs(DeltaO) - RMSs(DeltaD)) ,0]} )

m3 = MAXt (4.2522*ALOG10(STDs(DeltaD) / STDs(DeltaO) ) )

SI = MAXt ( STDs(SO) )

TI = MAXt ( STDs(DeltaO) )
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See Contribution T1A1.5/92-112 for more explanation on q, m1, m2, and m3.
See Contribution T1A1.5/92-134 for more explanation on SI and TI.

Note: This document specifies the equations for m1 and q as originally given in document T1A1.5/92-112. Document T1A1.5/92-135 specifies alternate equations for m1 and q that are more computationally efficient.