COMMITTEE T1

CONTRIBUTION

Document Number: T1A1.5/94-120

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

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TITLE: NTIA/ITS Objective Test Results

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ISSUE ADDRESSED: T1A1.5 Subjective Testing

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SOURCE: National Telecommunications and Information Administration

Institute for Telecommunication Sciences

Margaret Pinson & Coleen Jones

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KEYWORDS: Video Quality, Video Performance Specifications, Objective Quality, Subjective Quality

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DISCLAIMER:

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1. Introduction

The Institute for Telecommunication Sciences has completed calculation of the thirteen objective video quality parameters given in T1A1.5/93-152 and 153. The objective data for all twenty-five HRCs has been made available to T1A1.5 participants. The time histories of the source and destination video data were aligned using the automated alignment algorithm specified in T1A1.5/93-152 (and corrections as given in section 2 of T1A1.5/94-150) prior to computation of the parameter values.This document describes how to access the data. Also included in this document is an error analysis between two processing runs using our laboratory system.

2. Data Access

The data has been posted on a Unix workstation at ITS. It can be accessed in the following manner from any computer with Internet access:

ftp ntia.its.bldrdoc.gov

Name: **anonymous**

Password: **<Your email address>**

ftp> **cd dist/t1a1/objective**

ftp> **ascii**

ftp> **get <filename>**

ftp> **bye**

It is suggested that the files be transferred using ascii mode to prevent transmission errors. The read.me file contains a complete description of all the objective data files available for transfer.

The following files are available in this directory:

read.me	"Read me" information file
align.readme	Alignment technical details
PARS.DAT	Parameters P1-P13 (first method of measurement).
ALTPARS.DAT	Parameters P1-P11 (alternate method of measurement).
align.tc	Time code of first frame
scenes	Scene name to letter cross reference

Please direct questions or problems to:

Margaret Pinson	303-497-3579	margaret@its.bldrdoc.gov
Coleen Jones	303-497-3764	cjones@its.bldrdoc.gov

3. Data Summary

3.1 File 'align.tc' & 'align.readme'

File 'align.tc' lists for each scene / HRC combination the time code of the first frame of the nine-second (270 -frame) clip over which the thirteen ITS parameters were

computed. These time codes correspond to time codes on HRC tapes 1 through 25. Source scene time codes are also included in file 'align.tc'. The source scene time codes listed are identical to those used to edit the viewing tapes.Time codes for the source scenes correspond to time codes on HRC tape 100, a dub of HRC tape 1.

File 'align.readme' contains a description of how the time codes were computed.

3.2 PARS.DAT

File 'PARS.DAT' lists the 13 objective video quality parameters described in contribution T1A1.5/93-152 and T1A1.5/93-153. These 13 parameters were computed over the 270 frames following the alignment time codes listed in file 'align.tc', described above. File 'PARS.DAT' contains fifteen columns. The first and second columns contain each scene letter and HRC number respectively, which together identify one scene / HRC combination. The next thirteen columns list the values computed for the thirteen video quality parameters, P1 through P13. The first method of measurement was used for both the SI and TI features, as described in sections 2.1 and 2.3 of contribution T1A1-5/93-152, "A Summary of Methods of Measurement for Objective Video Quality Parameters Based on the Sobel Filtered Image and the Motion Difference Image".

The Fourier Transform parameters, P12 and P13 (T1A1.5/93-153), were computed on the T1A1 video before time alignment was computed. Since these parameters are only calculated every six frames, the alignments chosen by the automated algorithm were not usually available for these parameters. The alignment used for these parameters will be within three frames of the alignment specified in align.tc.

3.3 ALTPARS.DAT

File 'ALTPARS.DAT' lists the eleven objective video quality parameters computed from the alternate method of measurement for both the SI and TI features, as described in sections 2.2 and 2.4 of contribution T1A1.5/93-152. The eleven parameters were computed using the alignment time codes listed in file 'align.tc'. File 'ALTPARS.DAT' contains thirteen columns. The first and second columns contain each scene letter and HRC number respectively, which together identify one scene / HRC combination. The next eleven columns list the values computed for the eleven video quality parameters, P1 through P11.

3.4 Feature Data

Time histories of Temporal Information, Spatial Information, and Fourier Transform-based features will be provided upon request.

4. Parameter Repeatability Check

To quantify the repeatability of the thirteen parameters and to demonstrate the amount of variation which can be expected from hardware variation, ITS made two separate passes through the thirteen parameter calculations. The two computations were made using the same HRC video tapes, the same hardware configuration, and using the same software modules to compute the parameters. The first pass through the data was fully completed before the second pass began. Table 1: "Parameter Repeatability Results" summarizes the variations observed within the parameter calculations. The average difference and standard deviation of differences are listed, along with the range of differences observed. Repeatability information for parameters 12 and 13 is not available, because the sub-sampled calculations occurred on different frames for the majority of the scene / HRC combinations.

Table 1: Parameter Repeatability Results

Parameter	mean	std	minimum	maximum
1	0.00087	0.00984	-0.139	0.112
2	0.00207	0.00628	-0.013	0.033
3	0.00523	0.01406	-0.122	0.080
4	0.00305	0.00899	-0.049	0.044
5	0.00167	0.00769	-0.067	0.058
6	0.00130	0.00758	-0.031	0.060
7	-0.00056	0.00934	-0.084	0.031
8	-0.00081	0.00802	-0.030	0.026
9	-0.00113	0.00891	-0.031	0.027
10	0.00250	0.11116	-1.623	1.414
11	-0.00029	0.01741	-0.232	0.164

Table 2: "Parameter Differences, Weighted to Reflect Quality Changes" lists the repeatability difference statistics, weighted to reflect changes in quality relative to the five-point rating scale used in the subjective tests. The weights listed in the second column were created by training a first-order linear predictor, using the given objective parameter, on the mean scores computed over ITS and GTE valid viewer subjective data.

Note that for all of the parameters except P10, the standard deviation of the difference (std) between the two passes is on the order of 0.01 to 0.01 quality units, with the maximum observed error being less than 0.3 quality units. For parameter 10, the minimum and maximum differences are relatively high. This condition is manifested when scenes that display both small and large amounts of motion are combined with

HRCs that contain high frame repeat rates. For these conditions, small changes in the source variation threshold, which is used to detect frame updates, can cause large changes in the parameter value. Investigations are underway to identify a suitable dynamic threshold to improve this parameter. The aforesaid instability was observed in 19 of the 625 scene / HRC combinations. Parameter 10 values showed no change in 594 of the 625 scene/HRC combinations.

Table 2: Parameter Differences, Weighted to Reflect Quality Changes

Parameter	Weight	mean	std	minimum	maximum
1	1.885	0.00164	0.0185	-0.262	0.211
2	3.322	0.00687	0.0208	-0.045	0.112
3	1.173	0.00614	0.0164	-0.143	0.094
4	2.607	0.00795	0.0234	-0.129	0.115
5	3.614	0.00604	0.0277	-0.242	0.212
6	4.379	0.00568	0.0331	-0.138	0.266
7	3.525	-0.00198	0.0329	-0.296	0.111
8	4.218	-0.00341	0.0338	-0.127	0.110
9	4.051	-0.00458	0.0361	-0.126	0.111
10	1.722	0.00430	0.1914	-2.795	2.436
11	1.153	-0.00034	0.0200	-0.267	0.189