QUANTILE DATA ANALYSIS OF IMAGE DATA

Emanuel Parzen
Department of Statistics
Texas A&M University
College Station, Texas 77843

ABSTRACT

Quantile data analysis and functional statistical inference methods are introduced and applied to provide representations of spectral data which may lead to simple statistical discriminators effective for the estimation of ground truth from satelite spectral measurements.

To estimate the ground truth of a pixel, we propose to estimate the probability of each possible ground truth, given observed (estimated) quantile-theoretic statistical characteristics of the multi-spectral image data corresponding to the pixel and its neighboring pixels. This paper describes a research strategy for determining which statistical characteristics discriminate best.

Results are reported of quantile data analysis of an extensive collection of training files of image data.

1. Introduction

To conduct research in image analysis, one must define its data, ends, and means.

The data consists of files. An image file consists of measurements taken on a specified date at a specified 5 x 6 nautical mile site on the earth's surface. A site is divided into a rectangular grid of (more than 20,000) surface elements [approximately 1 acre] called pixels. On each pixel, spectral measurements are made by satelite on four (and perhaps seven) channels [of the electromagnetic energy spectrum]. Each spectral measurement is an integer from 0 to 256.

The ends [goals] of image analysis is to estimate ground truth within the pixel; labels for ground truth include alfalfa, corn, soybeans, sugar beets, spring wheat, spring oats, grass, pasture, trees, water.

A file is called a training file if a ground truth record is available; each pixel is divided into six sub-pixels and ground truth is recorded for each sub-pixel.

The means of image analysis are currently under investigation by many investigators. A probability approach considers ground truth as a parameter [denoted θ]. A formal Bayesian statistical solution to the estimation of ground truth from data is to calculate $p(\theta|\text{data})$, the posterior probability distribution of θ [the ground truth parameter] given the data. A formal maximum likelihood solution to the estimation of ground truth from data consists of two steps: (1) calculate the likelihood function of θ, which equals $p(\text{data}|\theta)$, the conditional distribution of the data given that it is observed from a pixel with ground truth θ, and (2) use optimization algorithms to determine $\hat{\theta}$, the parameter value which maximizes likelihood. The foregoing formal statistical procedures are often described as being theoretically "optimal." But they may not be "good" in practice in the sense of correctly identifying ground truth with high probability.

To obtain high probability of discrimination, we recommend (1) measuring suitable characteristics of probability models of the data, (2) treating the measured characteristics as new data, and estimating the likelihood function $p(\text{measured characteristics of data}|\theta)$, and (3) determining characteristics whose distributions for different values of θ are as wide apart as possible [the likelihood function is not flat and its optimum is easily determined].

This paper investigates the use of quantile data analysis to obtained measured characteristics of image data which have good power of discrimination between different values of ground truth. Only univariate analysis methods are used on channel 2 and channel 3 spectral observations. Future research will be concerned with bivariate analysis of the joint distribution of channel 2 and channel 3 measurements. Our approach to quantile data analysis strongly recommends that bivariate analysis be built on a foundation of univariate analysis. Therefore the univariate analysis techniques developed in this paper will not be rendered obsolete by the bivariate techniques to be developed in future research.

2. Outline of Quantile-Data Analysis of a Pixel

Let us describe a proposed method of statistical data analysis based on characteristics of the sample quantile functions of batches of measurements. Given a pixel whose ground truth we would like to estimate, let (t_1,t_2) be its coordinates which represent its position within the rectangular grid of pixels into which the scene has been divided.

Define $A_\nu(t_1,t_2)$, the ν-neighborhood of a pixel, to be the set of pixels with coordinates $(t_1 + j_1, t_2 + j_2)$, where $j_1,j_2=0,\pm1,\ldots,\pm\nu$. For example $A_1(t_1,t_2)$ contains 9 pixels, $A_2(t_1,t_2)$ contains 25 pixels, $A_3(t_1,t_2)$ contains 49 pixels.

For k=2 and 3, the channel k measurements of the pixels in $A_\nu(t_1, t_2)$ are collected to form a <u>data</u> <u>batch</u> whose sample quantile function $\tilde{Q}(u)$ is formed. The "measured data characteristics" we associate with a pixel are various characteristics of the sample quantile function of a batch of measurements formed from the pixels surrounding a given pixel. The remainder of this section reviews quantile data analysis and defines the summary statistics that it suggests.

The probability law of a random variable X is usually described by its distribution function $F(x)=\Pr[X\leq x]$, $-\infty<x<\infty$, and probability density function $f(x)=F'(x)$. The quantile approach uses [see, for example, Parzen (1983)]

(1) $Q(u) = F^{-1}(u) = \inf\{x:F(x)\geq u\}$,

(2) $q(u) = Q'(u)$,

(3) $fQ(u) = f(Q(u)) = \{q(u)\}^{-1}$, and since $\frac{d}{du} F(Q(u)) = 1 \Rightarrow f(Q(u)) \cdot q(u) = 1$

(4) $J(u) = -(fQ)'(u)$.

A quick measure of location is the median $Q(0.5)$. A quick index of scale is the interquartile range $Q(0.75) - Q(0.25)$, formed for the quartiles $Q(0.25)$ and $Q(0.75)$.

Quick measures of distributional shape are provided by values (as u tends to 0 and 1) of the informative quantile function [recently introduced by Parzen].

$$IQ(u) = \frac{Q(u) - Q(0.5)}{2\{Q(0.75) - Q(0.25)\}} , \quad 0 \leq u \leq 1.$$

We cannot emphasize how powerful the IQ function appears to be in practice as a tool for the diagnosis of distributional shapes.

The IQ function is independent of location and scale parameters. It is approximately equivalent to normalizing a quantile function to have the properties $Q(0.5) = 0$, $Q'(0.5) = 1$. The IQ graph of the function provides us at a glance with a vague estimate of tail behavior as defined by tail exponents.

A fundamental description of the tail behavior of distributions is provided by the left tail exponent α_0 and the right tail exponent α_1 defined as follows:

$$fQ(u) = u^{\alpha_0} L_0(u) \text{ as } u \to 0$$

$$fQ(u) = (1-u)^{\alpha_1} L_1(u) \text{ as } u \to 1$$

where $L_0(u)$ and $L_1(u)$ are slowly varying functions.

A function $L(u)$ is slowly varying as $u \to 0$ if, for every $y > 0$,

$$\lim_{u \to 0} \frac{L(yu)}{L(u)} = 1.$$

Tail behavior is defined in terms of a tail exponent as follows:

$\alpha<1$: short tail

$\alpha=1$: medium tail

$\alpha>1$: long tail

Medium tail ($\alpha=1$) distributions are further classified by the value of

$$h_0 = \lim_{u \to 0} \frac{f(u)}{u}, \quad h_1 = \lim_{u \to 1} \frac{f(u)}{1-u} \quad ;$$

the letter h is suggested by the notion of hazard function. We define

$h = 0$: medium-long tail

$0 < h < \infty$: medium-medium tail

$h = \infty$: medium-short tail .

Extensive calculations of informative quantile functions indicate that the value IQ_0 of $IQ(u)$ for u near 0 is a quick indicator of left tail behavior:

$-0.5 \leq IQ_0 < 0$: short left tail,

$-1.0 \leq IQ_0 < -0.5$: medium-short left tail,

$IQ_0 < -1.0$: medium-medium to long left tail.

proof ?
→ investigate

Similarly the value IQ_1 of $IQ(u)$ for u near 1 is a quick indicator of right tail behavior:

$0 < IQ_1 \leq 0.5$: short right tail,

$0.5 < IQ_1 < 1.0$: medium-short left tail,

$1.0 < IQ_1$: medium-medium to long right tail .

An important family of distributions is the Weibull with shape parameter β . Its quantile function Q(u) is of the form

$$Q(u) = \mu + \sigma Q_0(u)$$

where

$$Q_0(u) = \frac{1}{\beta} \{\log (1-u)^{-1}\}^{\beta} \quad .$$

Its density-quantile

$$f_0 Q_0 (u) = (1-u) \{\log (1-u)^{-1}\}^{1-\beta} \quad .$$

Its right tail exponent is $\alpha = 1.$, and its left tail exponent is $\alpha_0 = 1-\beta$. Insight into the interpretation of informative quantile functions is obtained by computing them for Weibull distributions.

Given data, we distinguish three types of estimators of population parameters, which we call: (1) fully non-parametric, (2) fully parametric, and (3) functional-parametric. Fully non-parametric estimators assume no model, and provide quick estimators. Fully parametric estimators assume a model known up to a finite number of parameters which must be estimated. Functional-parametric estimators are based on methods of functional statistical inference.

A fully non-parametric estimator $\tilde{Q}(u)$ of Q(j), given a sample of n distinct values $X_{1;n} < X_{2;n} < \ldots < X_{n;n}$, is defined by (for $j=1,\ldots,n$)

$$\tilde{Q}(u) = X_{j;n} \quad , \quad \frac{j-1}{n} < u \leq \frac{j}{n} \quad .$$

For a large sample, or for grouped values, we form a histogram before computing $\tilde{Q}(u)$ by linear interpolation at an equi-spaced grid of values kh, $k=1,2,\ldots,[1/h]$ where usually $h = 0.01$.

3. Example and Interpretation of a Quantile Data Analysis

To illustrate the uses of measured data characteristics provided by quantile data analysis, let us consider the analysis of a training file which contains both image data and ground truth data. We search through the ground truth file to see what codes appear more than a few times. The codes found to be present corresponded to the ground truth values listed in Table A. For a ground truth value j, we created a data batch consisting of all the channel 2 values observed in a pixel one of whose sub-pixels had a ground truth equal to the value j. We created a similar data batch of channel 3 observations. Table A lists the sample sizes of the number of observations in these data batches and the medians and interquartile ranges of the channel 2 and channel 3 observations. One immediately sees a pattern which might provide a discrimination statistic Δ to be used in determining ground truth. One might be able to readily distinguish the category "grass, pasture, trees" from "corn, soybeans, sugar beets, spring wheat, spring oats" by the values of

$$\Delta_1 = \text{median (channel 3)} - \text{median (channel 2)}$$

$$\Delta_2 - \log \frac{\text{IQ range (channel 3)}}{\text{IQ range (channel 2)}} \quad .$$

The values of these statistics are given in Table A. Note that $\Delta_1 > 2$ for grass, pasture, and trees, and $\Delta_1 < 2$ for crops. Of the crops, alfalfa is closest in statistical characteristics to grass, pasture, and trees; this conclusion is reached also in Table B.

Table A lists statistics based on comparisons of location and scale estimators; Table B lists discriminators which are based on shape and tail characteristics. We consider the following four characteristics as statistics which might discriminate between (ground truth) distributions:

$$\Delta_3 = \text{MEAN IQ} = \frac{\text{MEAN} - \text{MEDIAN}}{2 \times \text{INTERQUARTILE RANGE}}$$

$$\Delta_4 = \text{STD IQ} = \frac{\text{STANDARD DEVIATION}}{2 \times \text{INTERQUARTILE RANGE}}$$

$$\Delta_5 = IQ_0 = IQ(u) \text{ for } u \text{ near } 0$$

$$\Delta_6 = IQ_1 = IQ(u) \text{ for } u \text{ near } 1 .$$

The values of these statistics in this example indicate that trees, pasture, and grass have spectral observations with distributions closer to normal, while crops have spectral observations with distributions further from normal.

It should be strongly emphasized that these empirical patterns found in one file are not intended to be general algorithms applicable to all files. They are presented only as an <u>illustration</u> of the kinds of facts about image data which quantile data analysis proposes to discover through extensive computation on training files.

→ quantile-based statistics can be used as discriminators

TABLE A

	Sample Size	Median Channel 2	Median Channel 3	Δ_1 Median (3) -Median(2)
Alfalfa	377	19	20	1
Corn	8,755	15	14	-1
Soybeans	11,000	15	13	-2
Sugar Beets	793	14	12	-2
Spring Wheat	2,296	18	16	-2
Spring Oats	558	18	16	-2
Grass	174	23	26	3
Pasture	-248	-21	28	7
Trees	95	20	24	4

	IQ Range Channel 2	IQ Range Channel 3	Δ_1 Log IQ(3) -Log IQ(2)
Alfalfa	9	16.75	.62
Corn	5	6.5	.26
Soybeans	5	8	.47
Sugar Beets	4	4.5	.12
Spring Wheat	6	9	.41
Spring Oats	8	11	.32
Grass	8	12.5	.45
Pasture	5	13	.96
Trees	6	11	.61

TABLE B

	Mean IQ Channel 2	Mean IQ Channel 3	STD IQ Channel 2	STD IQ Channel 3
Alfalfa	-.08	-.07	.32	.27
Trees	-.08	-.01	.38	.35
Pasture	-.04	-.06	.41	.32
Grass	-.01	.02	.36	.34
Spring Wheat	.07	.11	.38	.41
Spring Oats	.09	.12	.36	.35
Sugar Beets	.14	.06	.42	.49
Corn	.17	.10	.44	.51
Soybeans	.17	.13	.46	.41

	IQ_0 Channel 2	IQ_0 Channel 3	IQ_1 Channel 2	IQ_1 Channel 3
Alfalfa	-.34	-.32	1.05	.68
Trees	-.75	-.72	1.0	.68
Pasture	-1.0	-.76	1.1	.65
Grass	-.75	-.72	.81	.68
Spring Wheat	-.58	-.44	2.08	1.66
Spring Oats	-.43	-.36	1.18	1.0
Sugar Beets	-.37	-.44	2.25	2.55
Corn	-.40	-.46	2.8	3.0
Soybeans	-.40	-.31	2.7	1.93

Note: STD IQ = .37 for normal. Above line characteristics close to normal. Below line characteristics far from normal.

4. Quantile Data Analysis of Statistical Characteristics Estimated from Pixel Nieghborhoods

A program of fundamental research on the quantile data analysis approach to picture segmentation poses many detailed problems for research. This section gives an example of one sample quantile data analysis. (1) Consider all pixels in a file whose ground truth is a specified crop (spring wheat is considered here). (2) For each such pixel form a 5 by 5 neighborhood of pixels (with the specified pixel at the center). (3) For each neighborhood form a data batch of spectral observations (channels 2 and 3 are considered here). (4) For each data batch, form its sample quantile function and estimate typical univariate quantile theoretic statistical characteristics: median, IQR (interquartile range), mean IQ (mean of informative quantile function), STDIQ (standard deviation of IQ function), IQ(.01), IQ(.99), average log spacings (which is a fully non-parametric estimator of entropy of the IQ function), and log σ_0 [where σ_0 is the score deviation, defined as the sum of products of the spacings of the IQ function and a specified density-quantile function $f_0Q_0(u)$]. The specified density quantile functions that we use are the logistic distribution

$$f_0Q_0(u) = u(1-u) \quad ,$$

and the Weibull distribution with quantile shape parameter β [we choose $\beta = 0.7$]

$$f_0Q_0(u) = (1-u) \{-\log (1-u)\}^{1-\beta}$$

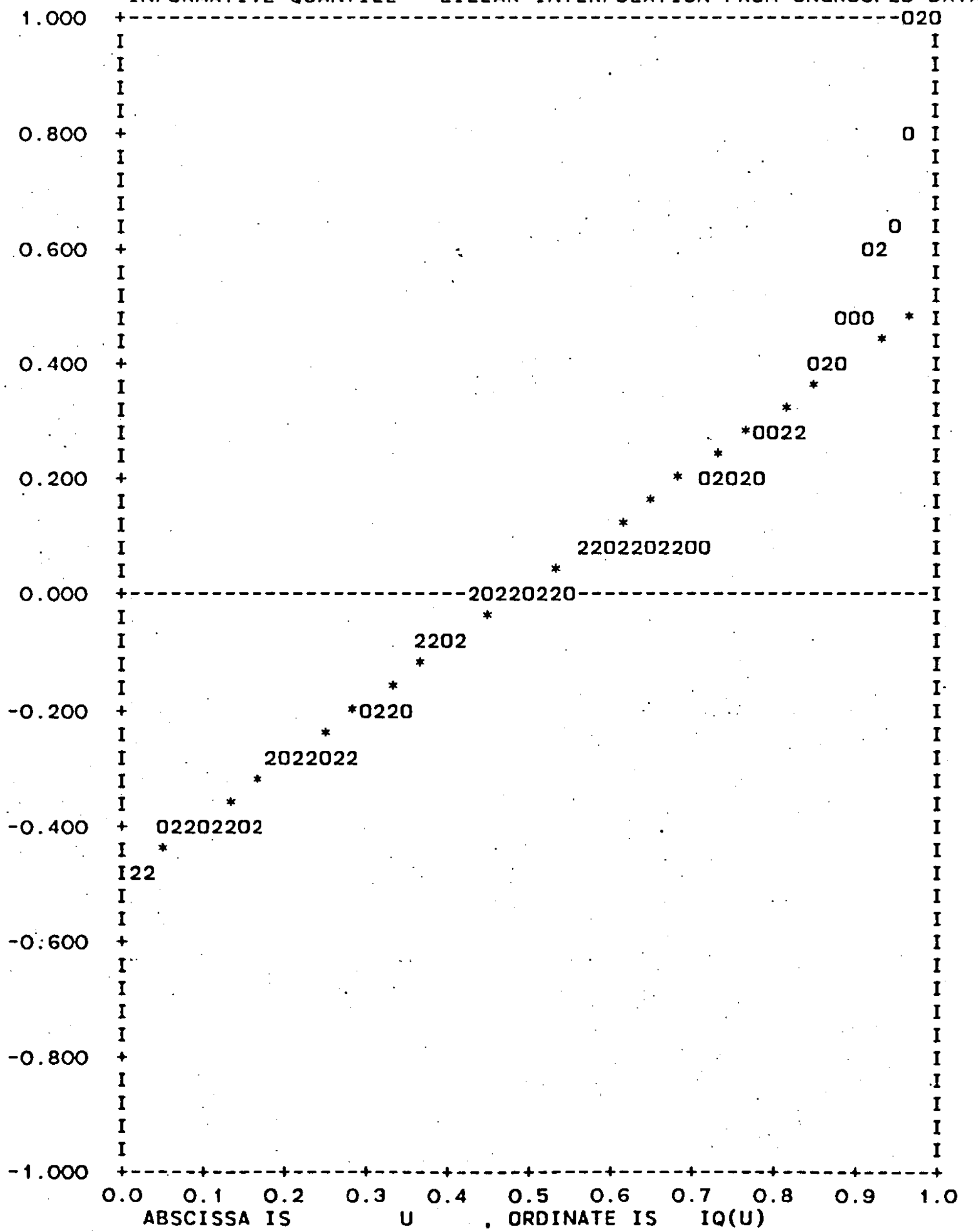
Step (5) is to form, for each statistical characteristic, a data batch of the several thousand estimates of that characteristic corresponding to the pixels in the training file with the specified ground truth [here, spring wheat (code 100)]. Step (6) is to do a one-sample quantile data analysis of this data batch. These analyses are presented in detail for the following estimators: median channel 2, mean IQ channel 2, median channel 3, mean IQ channel 3.

The following table lists some basic summary measures for a one-sample statistical analysis of a data batch of statistical characteristics of Spring Wheat pixel neighborhoods:

	Median Channel 2	Median Channel 3	Mean IQ Channel 2	Mean IQ Channel 3
Median	18	16	.02	.04
IQR	5	7.75	.14	.13
Mean IQ	.04	.09	.03	.01
Std IQ	.41	.36	.44	.49
Av. Log Spacings	-.68	-.59	.43	.43
σ_0 Weibull	.67	.61	.78	.80
σ_0 Logistic	.34	.20	.22	.22

We give for these variables: (1) printer plots of the informative quantile functions; (2) estimated density quantile functions, computed by the method of autoregressive density estimation; using the logistic and Weibull distributions as bases; and (3) diagnostic distribution functions (to be compared with the uniform) that help us decide which autoregressive order to accept as providing a "parsimonious" estimator.

SEG=1380 YR=1978 DY= 115 CH= 2 GT= 100
INFORMATIVE QUANTILE - LILEAR INTERPOLATION FROM UNGROUPED DATA



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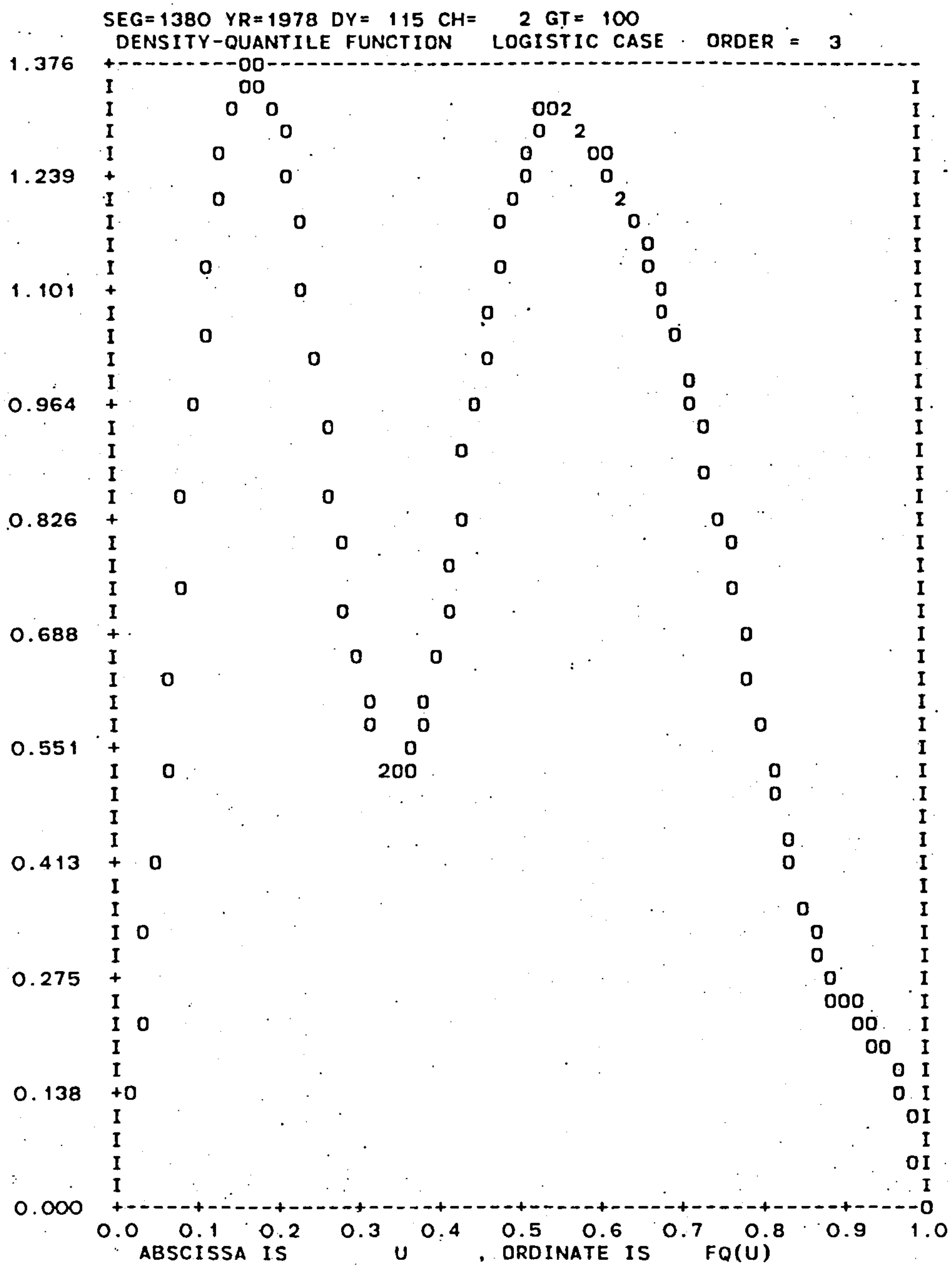
<u>Spring Wheat Pixel Neighborhood Channel 2</u>

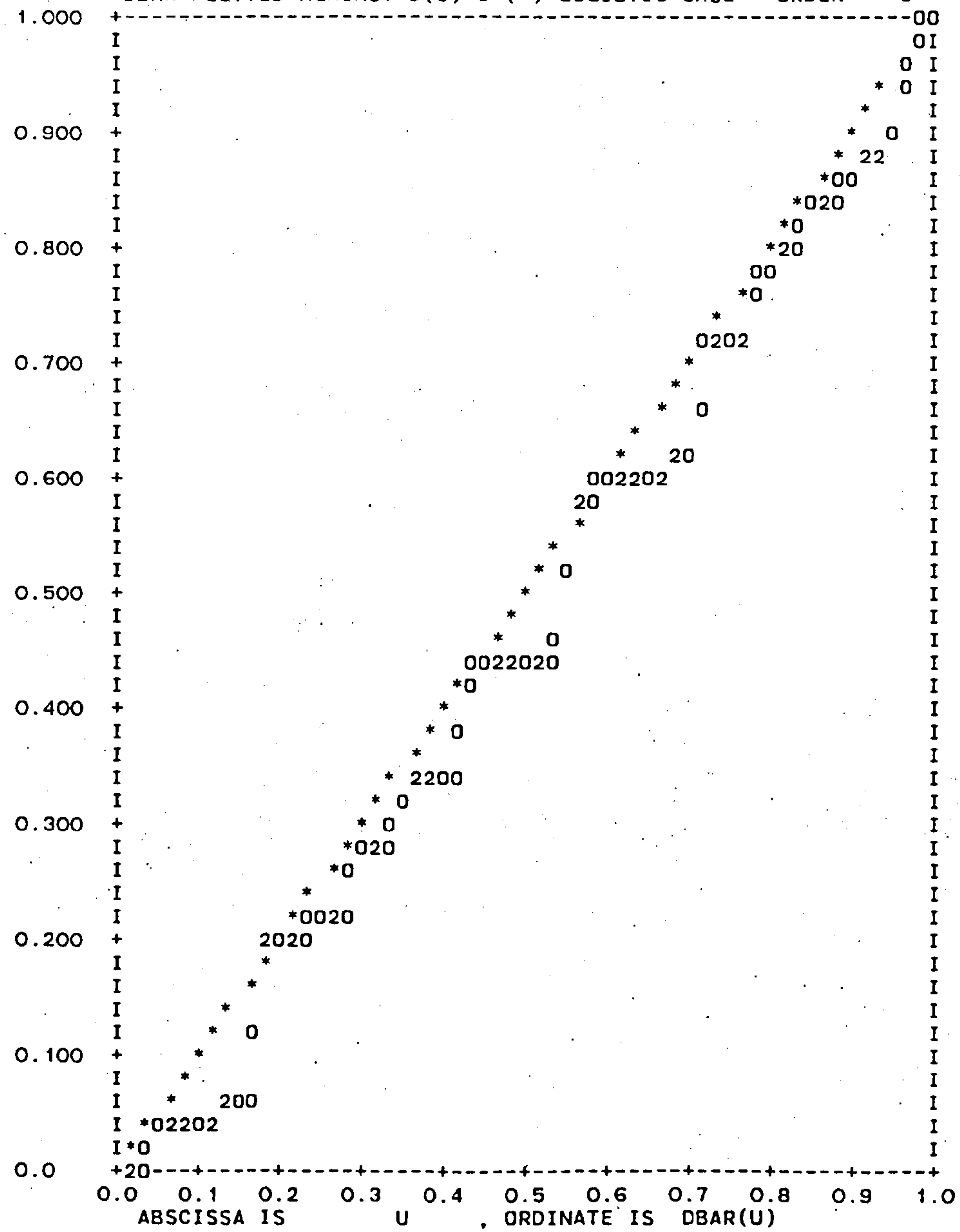
<u>Medians</u>: IQ Plot indicates not normal but possibly Weibull. To test Weibull, we do not currently estimate shape parameter β, but choose $\beta = 0.7$.



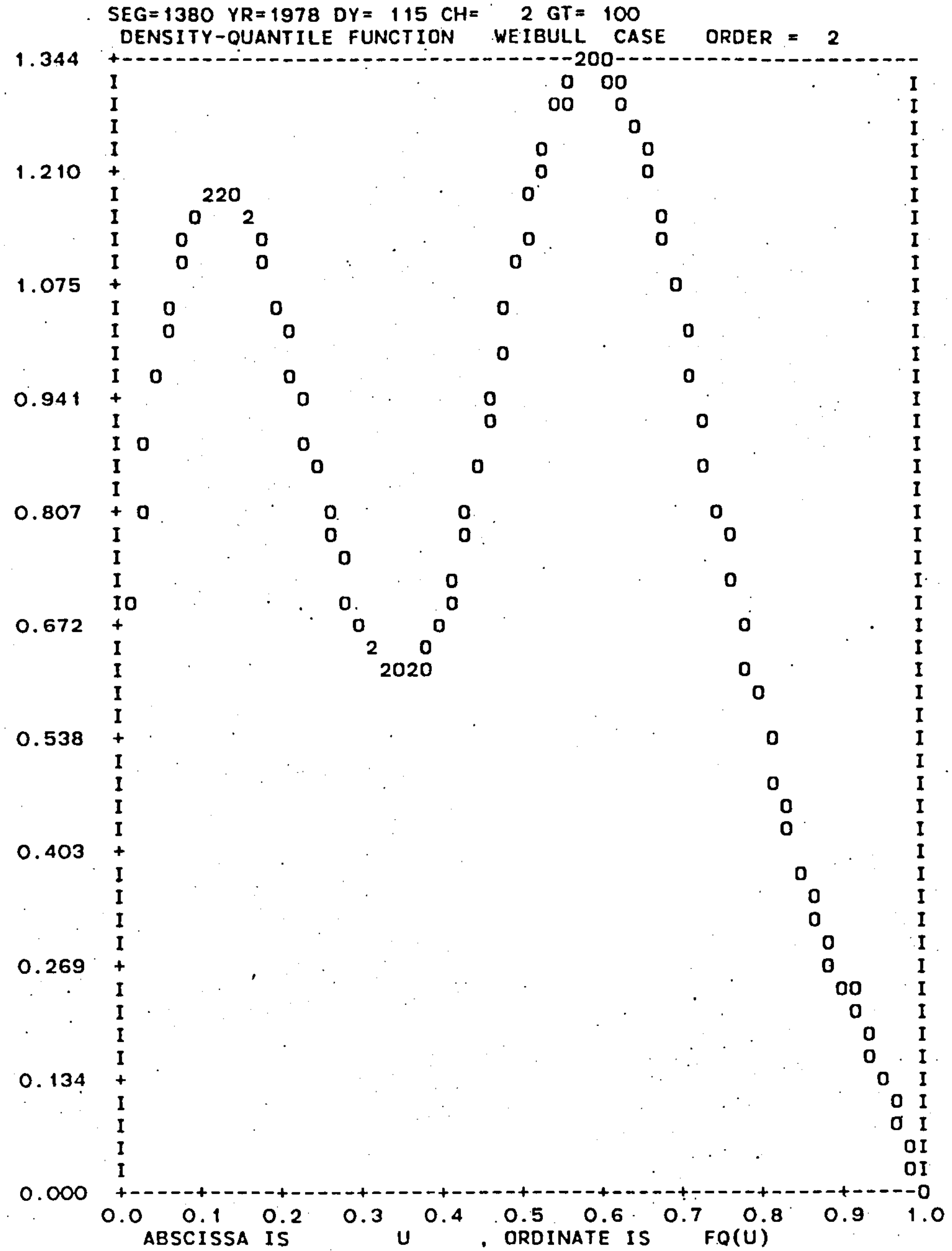
<u>Spring Wheat Pixel Neighborhood Channel 2</u>

<u>Medians</u>: Autoregressive density quantile estimator (with logistic base and order 3) indicates bimodal density.

SEG=1380 YR=1978 DY= 115 CH= 2 GT= 100
DBAR PLOTTED AGAINST D(U)=U (*) LOGISTIC CASE   ORDER = 3

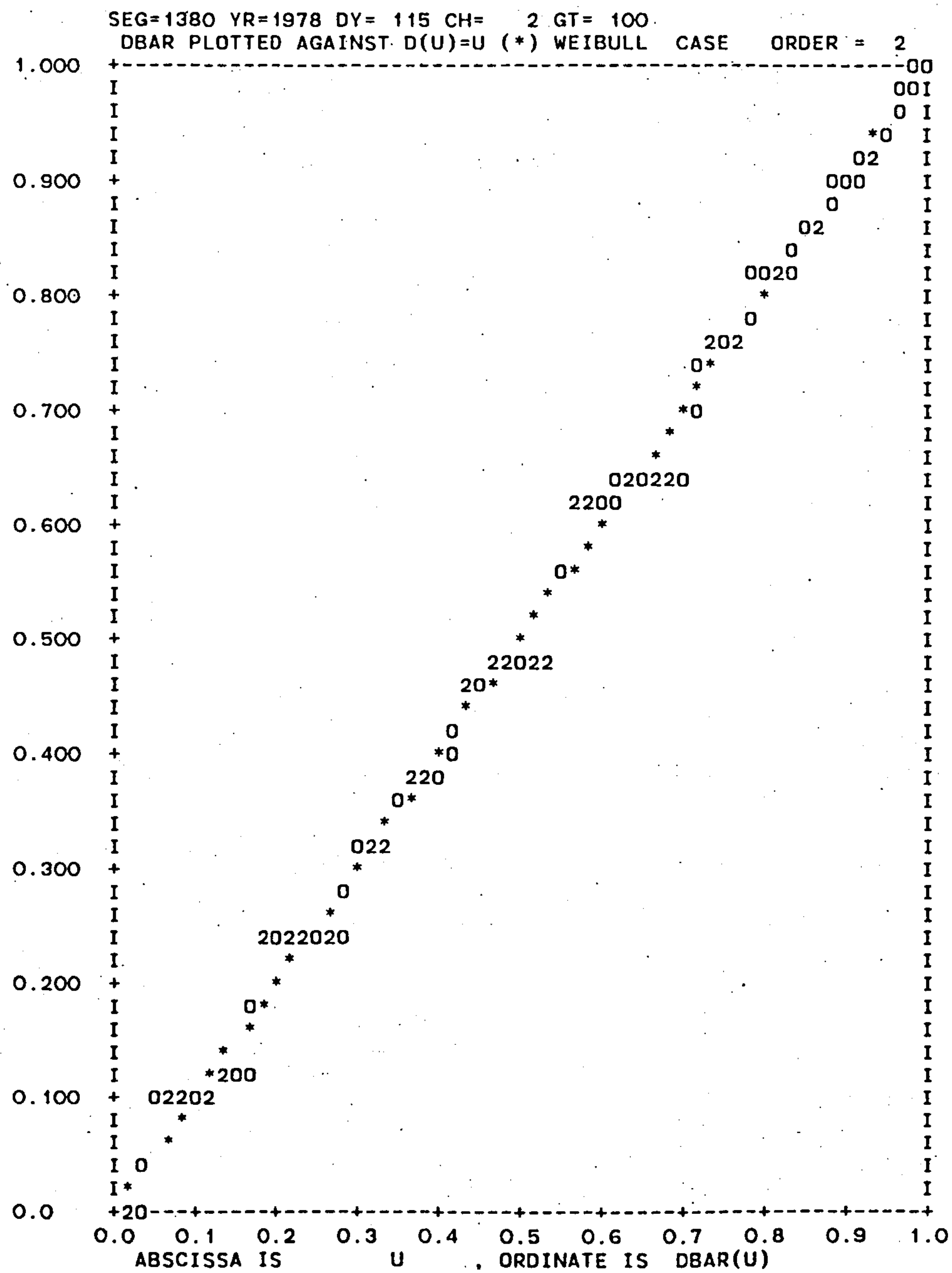


<u>Spring Wheat Pixel Neighborhood Channel 2 Medians</u>. Diagnostic of fit of AR density-quantile estimator (with logistic base and order 3).



Spring Wheat Pixel Neighborhood Channel 2

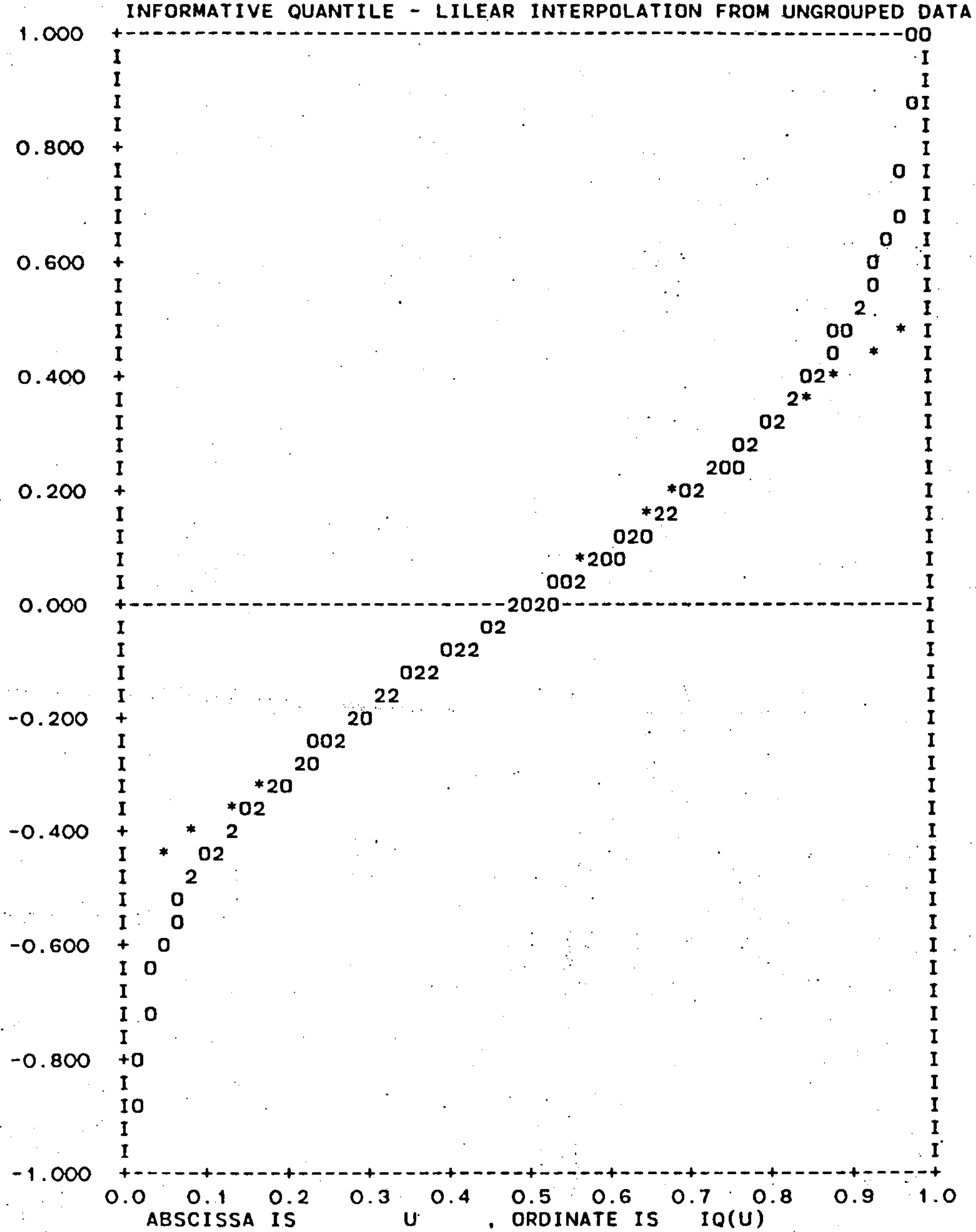
Medians: Autoregressive density quantile analysis (with Weibull shape parameter .7 base and order 2) indicates bimodal density.



Spring Wheat Pixel Neighborhoods Channel 2

Medians: Diagnostic of fit of AR density quantile estimator (with Weibull shape parameter .7 base and order 2).

SEG=1380 YR=1978 DY= 115 CH= 2 GT= 100
INFORMATIVE QUANTILE - LILEAR INTERPOLATION FROM UNGROUPED DATA



Spring Wheat Pixel Neighborhood Channel 2

Mean IQ: IQ plot indicates almost perfect normality.

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AUTOREGRESSIVE  PARAMETRIC  SELECT  ANALYSIS
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Mean IQ Logistic Base

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SQUARED MODULUS OF FOURIER COEFFICIENTS

                           ..........................................................
PHI2( 1) =  0.00099923                                                              *
PHI2( 2) =  0.00039880     *
PHI2( 3) =  0.00049510            *
PHI2( 4) =  0.00095499                                                           *
PHI2( 5) =  0.00067322                        *
```

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AUTOREGRESSIVE  PARAMETRIC  SELECT  ANALYSIS
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Mean IQ Weibull Case

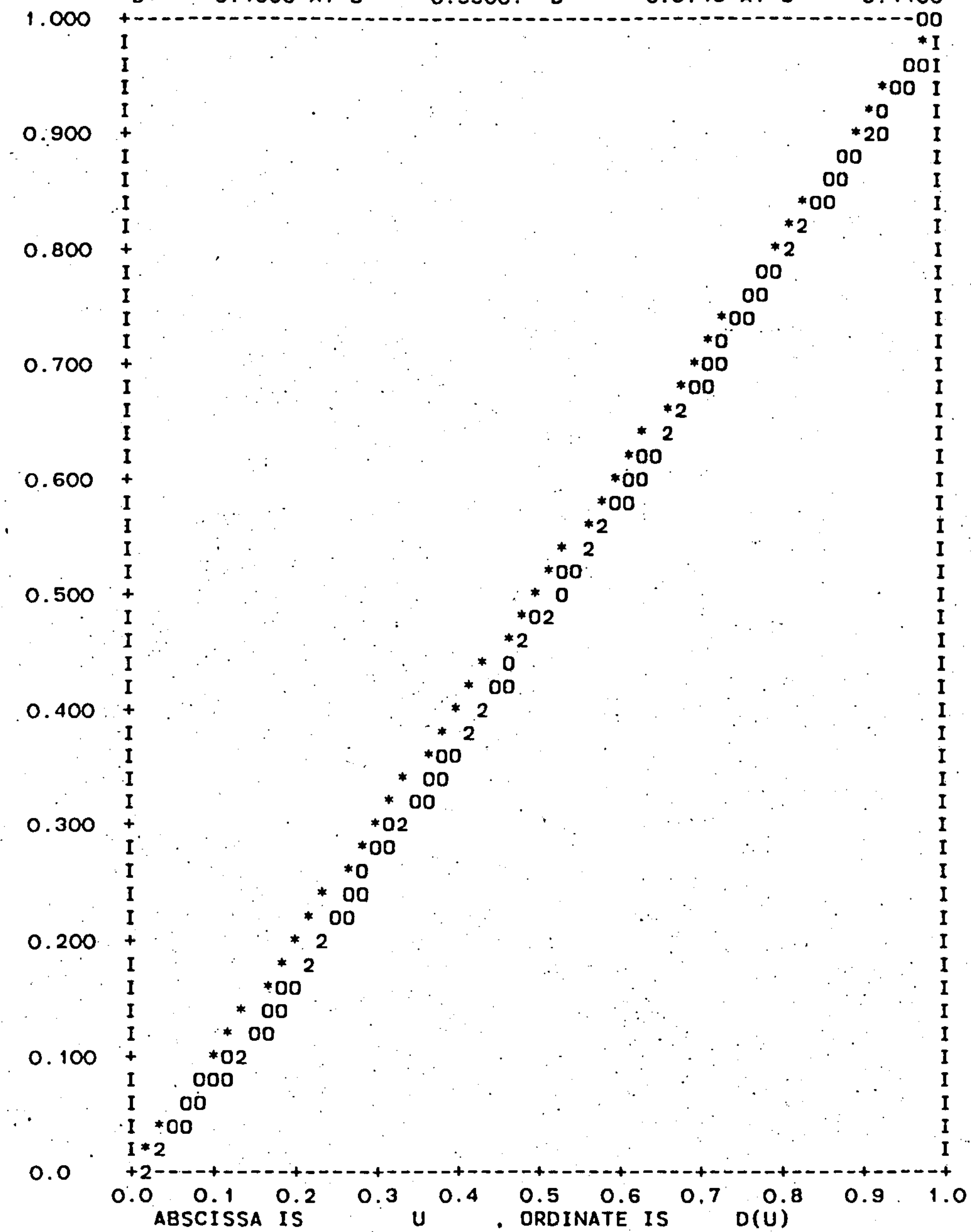
```
SQUARED MODULUS OF FOURIER COEFFICIENTS

                           ..........................................................
PHI2( 1) =  0.07646000                                                              *
PHI2( 2) =  0.03759194                     *
PHI2( 3) =  0.02402839              *
PHI2( 4) =  0.02089854          *
PHI2( 5) =  0.01483078     *
```

<u>Spring Wheat Pixel Neighborhood Channel 2 Mean IQ</u>: Pseudo-correlations square nodulus (phi 2) accept logistic distribution, reject Weibull distribution fit.

RAW DISTRIBUTION D(U) LOGISTIC CASE

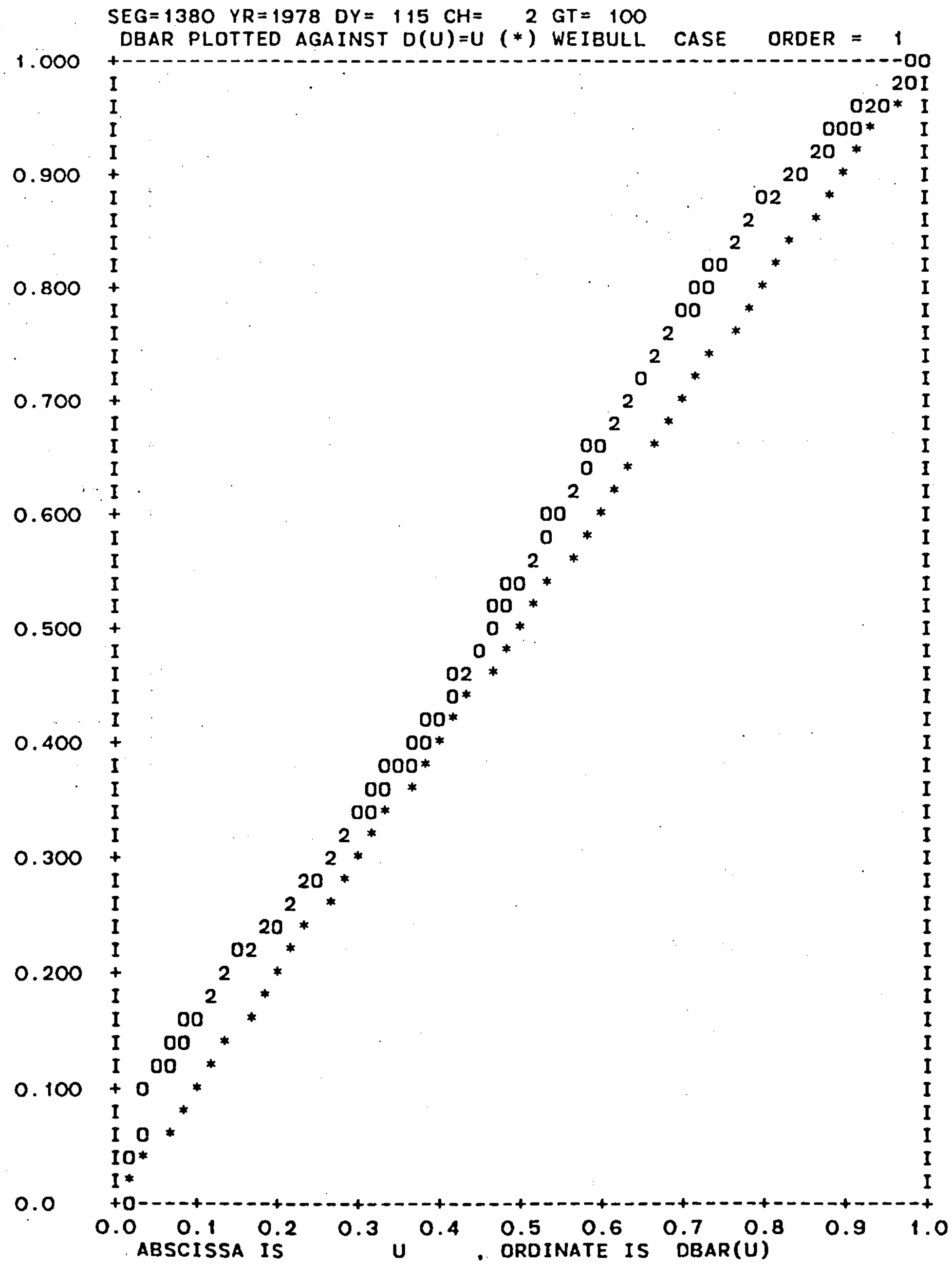
D+ = 0.1000 AT U = 0.9900. D- = -0.3745 AT U = 0.4400



Spring Wheat Pixel Neighborhood Channel 2

Mean IQ: Cumulative weighted spacings $\tilde{D}(u)$ plot indicates accept fit of logistic distribution.

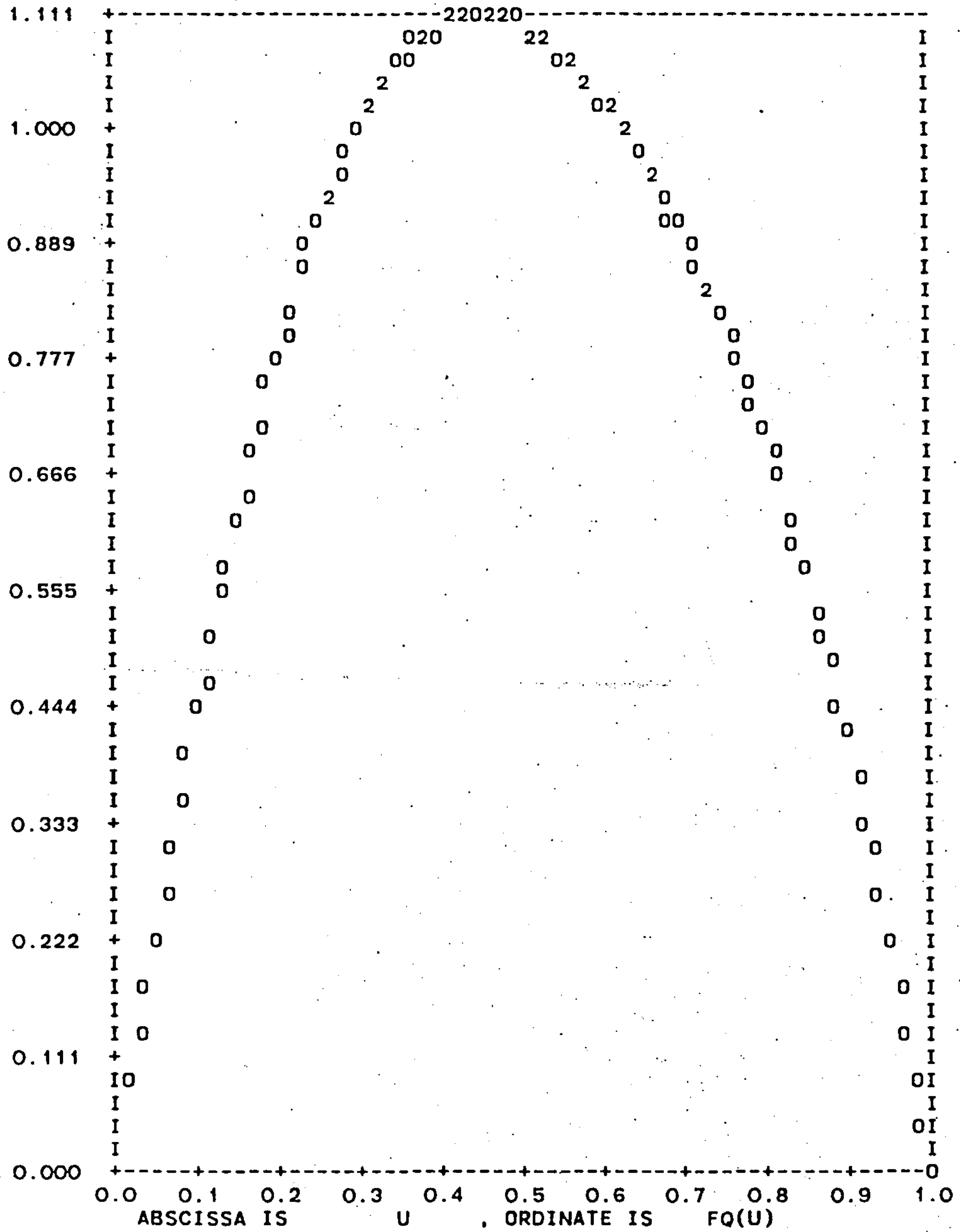
S T A T I S T I C A L   A N A L Y S I S   S Y S T E M   23:45 WEDNESDAY, MAY 18, 1983   41



Spring Wheat Pixel Neighborhood Channel 2

Mean IQ: Cumulative weighted spacings D(u) plot indicates reject Weibull distribution fit.

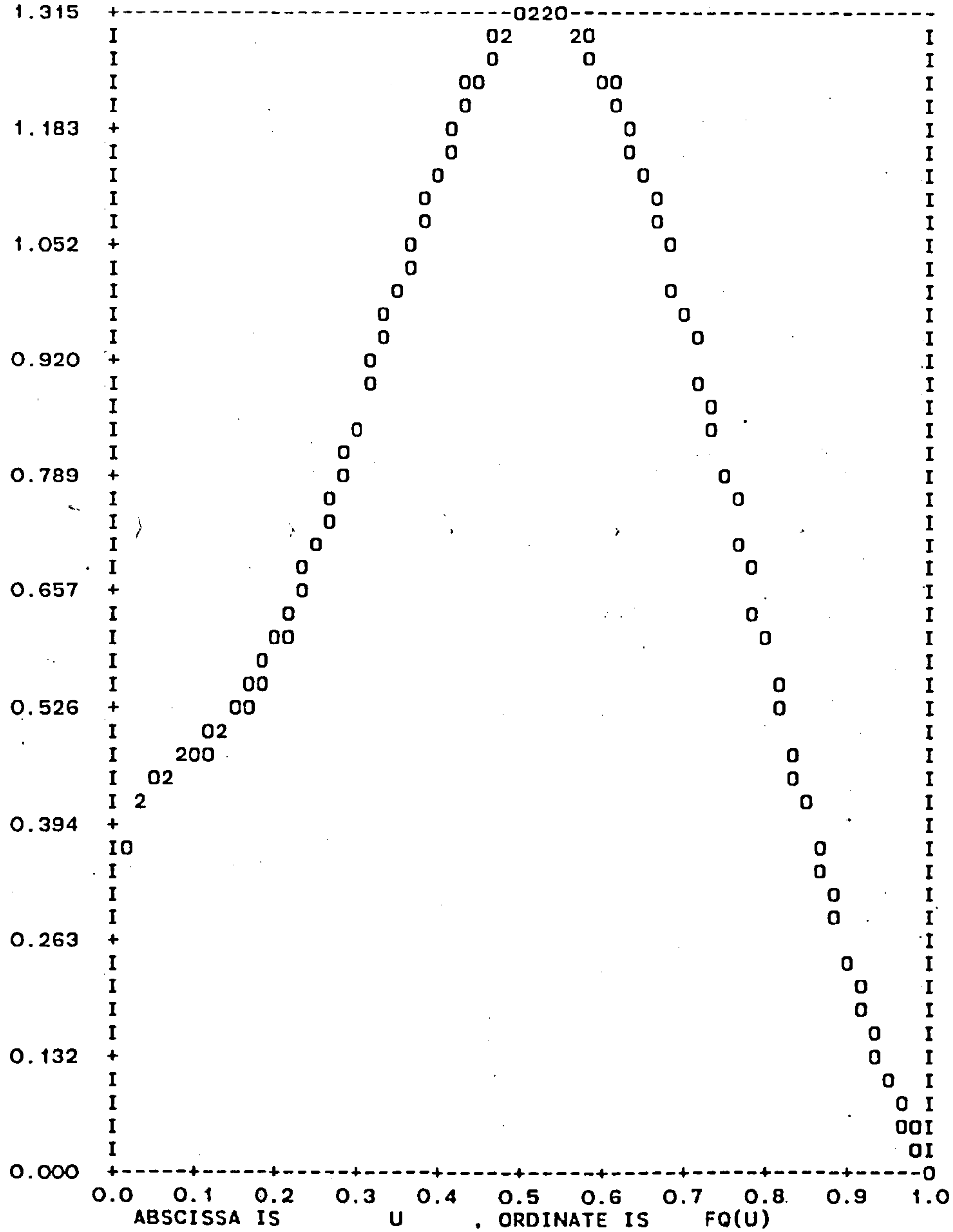
SEG=1380 YR=1978 DY= 115 CH= 2 GT= 100
DENSITY-QUANTILE FUNCTION   LOGISTIC CASE   ORDER = 1



Spring Wheat Pixel Neighborhood Channel 2

Mean IQ: Autoregressive density-quantile estimator (with logistic base and order 1) indicates normal-like density.

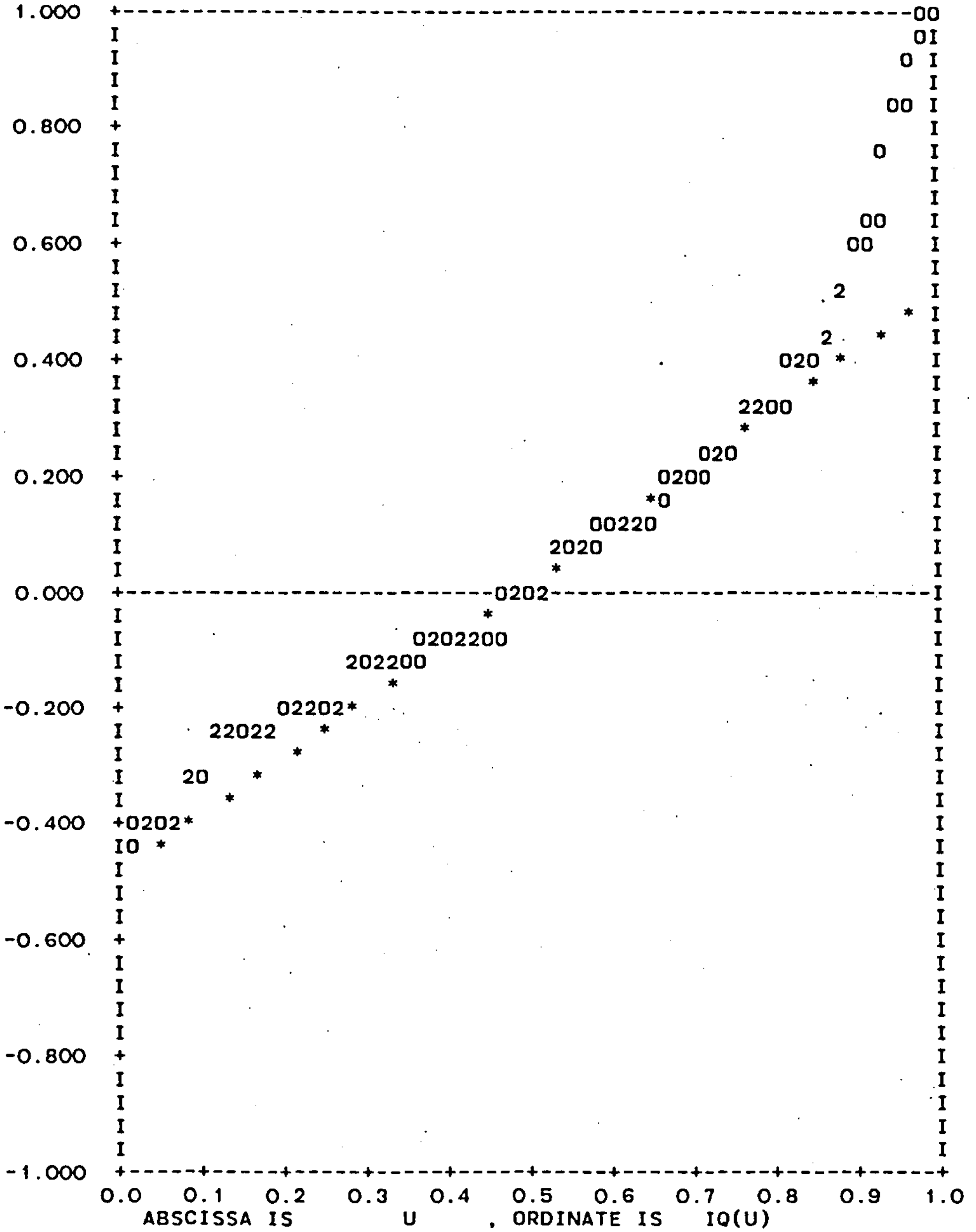
SEG=1380 YR=1978 DY= 115 CH= 2 GT= 100
DENSITY-QUANTILE FUNCTION   WEIBULL CASE   ORDER = 1



Spring Wheat Pixel Neighborhood Channel 2

Mean IQ: Autoregressive density-quantile estimator (with Weibull base and order 1) indicates density which is symmetric and unimodal but less normal-like.

SEG=1380 YR=1978 DY= 115 CH=   3 GT= 100
INFORMATIVE QUANTILE - LILEAR INTERPOLATION FROM UNGROUPED DATA



<u>Spring Wheat Pixel Neighborhood Channel 3</u>

<u>Medians</u>: IQ plot indicates not normal but possibly Weibull.

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S T A T I S T I C A L   A N A L Y S I S   S Y S T E M      20:12 WEDNESDAY, MAY 18, 1983  142

          AUTOREGRESSIVE  PARAMETRIC  SELECT  ANALYSIS
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Median Channel 3 Logistic

```
          SQUARED MODULUS OF FOURIER COEFFICIENTS

                              ............................................................
PHI2( 1) =  0.03838847                                                                   *
PHI2( 2) =  0.00517420              *
PHI2( 3) =  0.01129055                        *
PHI2( 4) =  0.00169468        *
PHI2( 5) =  0.01800444                                   *

          AUTOREGRESSIVE  PARAMETRIC  SELECT  ANALYSIS
          ------------------------------------------
```

Median Channel 3 Weibull

```
          SQUARED MODULUS OF FOURIER COEFFICIENTS

                              ............................................................
PHI2( 1) =  0.00177358          *
PHI2( 2) =  0.00257716            *
PHI2( 3) =  0.00229294           *
PHI2( 4) =  0.00134046        *
PHI2( 5) =  0.01826305                                                                   *
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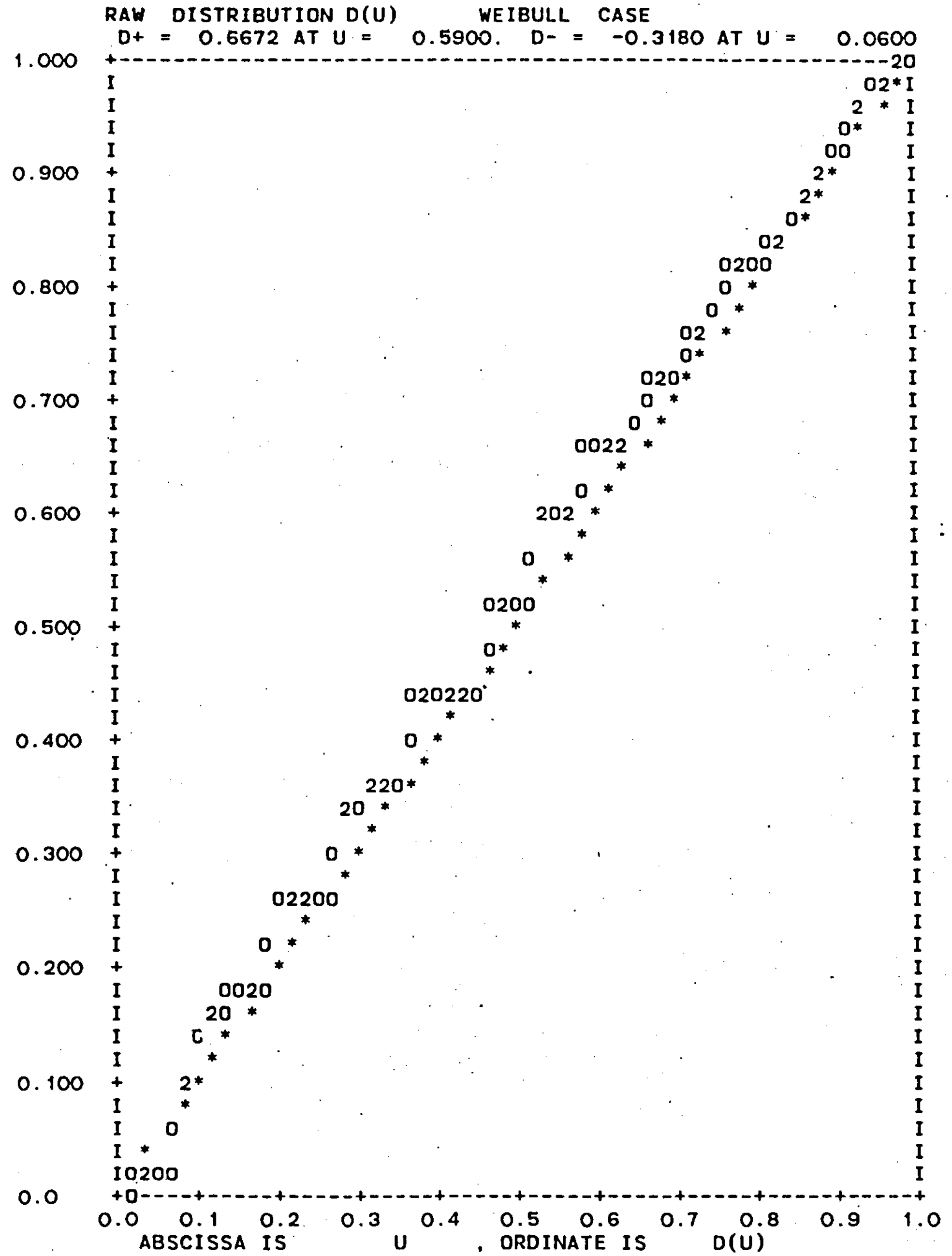
Spring Wheat Pixel Neighborhood Channel 3 Medians: Pseudo-correlations square modulus (phi 2) accept Weibull distribution, reject logistic distribution fit.

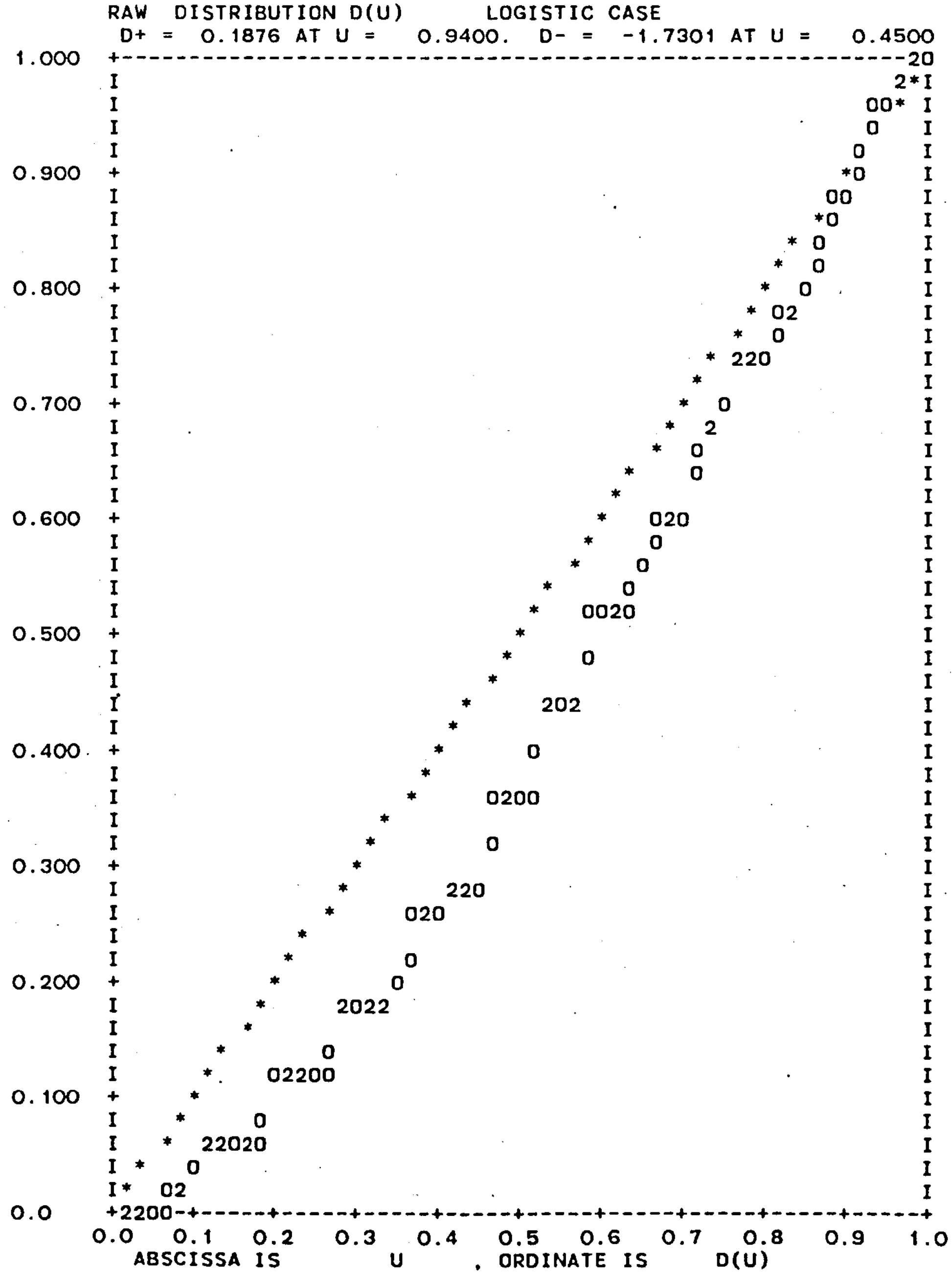


<u>Spring Wheat Pixel Neighborhood Channel 3</u>

<u>Medians</u>: Cumulative weighted spacings

$\tilde{D}(u)$ plot indicates accept fit of Weibull

distribution (shape parameter β =0.7).

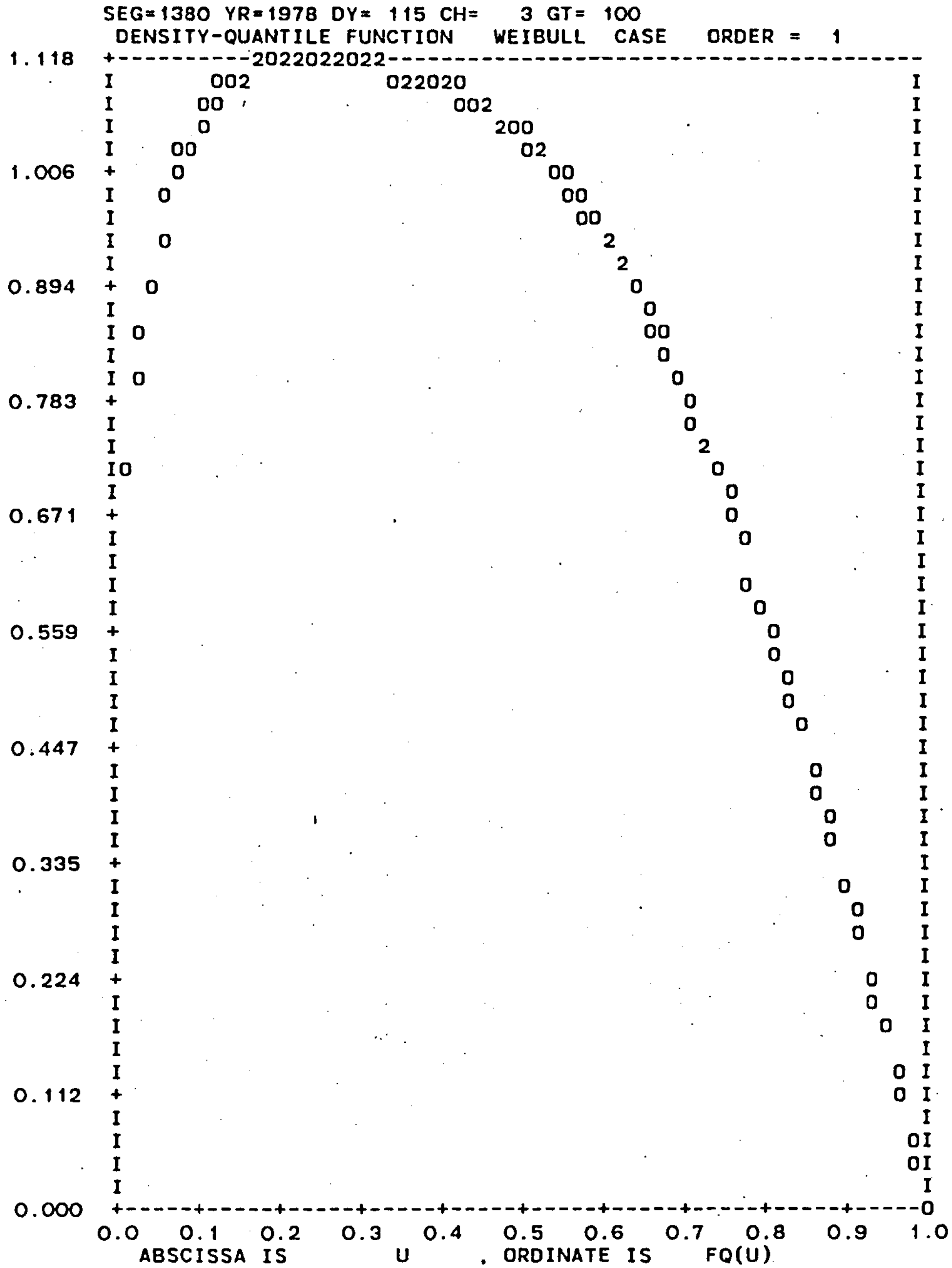


<u>Spring Wheat Pixel Neighborhood Channel 3</u>

<u>Medians</u>: Cumulative weighted spacings

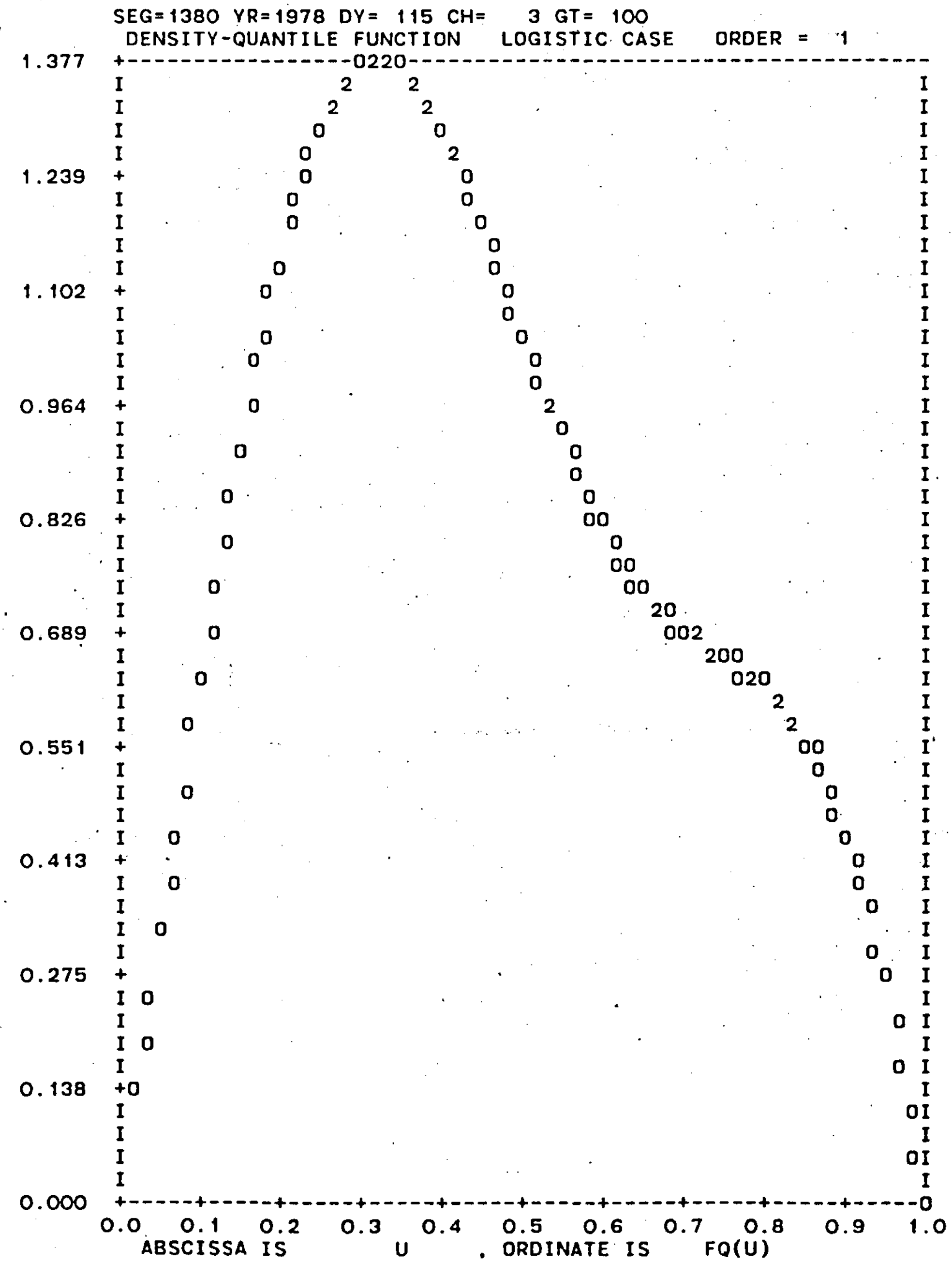
$\tilde{D}(u)$ plot indicates reject fit of

logistic distribution.



<u>Spring Wheat Pixel Neighborhood Channel 3</u>

<u>Medians</u>: Autoregressive density-quantile estimator (with Weibull base and order 1)



<u>Spring Wheat Pixel Neighborhood Channel 3</u>

<u>Medians:</u> Autoregressive density-quantile estimator (with logistic base and order 1).

SUMMARY OF AR PARAMETRIC SELECT ANALYSIS FOR LOGISTIC CASE

Median Channel 3

ORDER	RES_VAR	LOG(RES_VAR)	AIC	CAT
1	0.96161	-0.03914	-0.01914	-1.01922
2	0.94997	-0.05133	-0.01133	-1.01100
3	0.93683	-0.06525	-0.00525	-1.00444
4	0.92880	-0.07387	0.00613	-0.99229
5	0.91700	-0.08665	0.01335	-0.98433

OPTIMAL ORDER BY CAT CRITERION IS 1   MAXIMUM ORDER CHECKED IS 5

OPTIMAL ORDER BY AIC CRITERION IS 1   MAXIMUM ORDER CHECKED IS 5

SUMMARY OF AR PARAMETRIC SELECT ANALYSIS FOR WEIBULL CASE

Median Channel 3

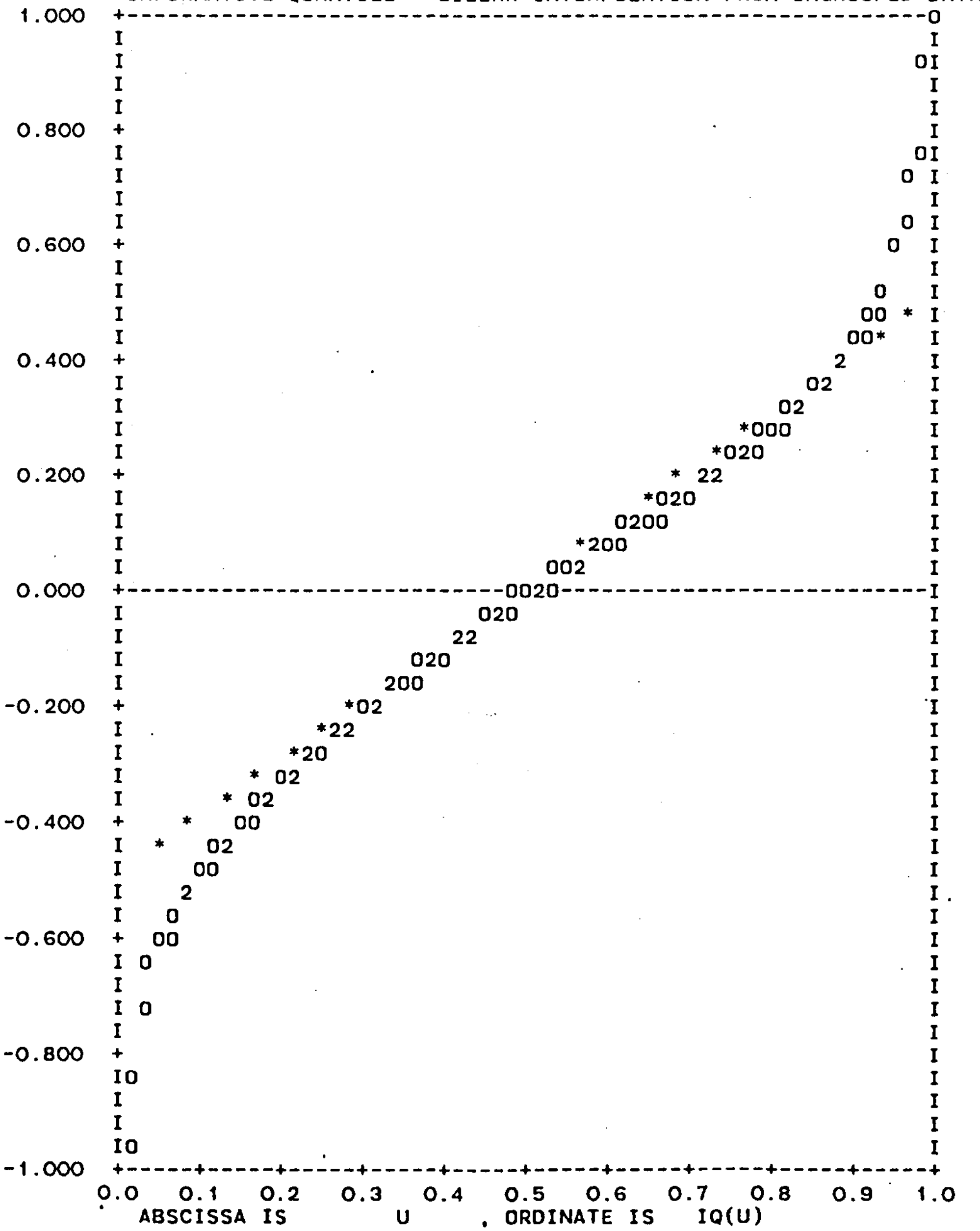
ORDER	RES_VAR	LOG(RES_VAR)	AIC	CAT
1	0.99823	-0.00177	0.01823	-0.98184
2	0.99556	-0.00445	0.03555	-0.96461
3	0.99366	-0.00636	0.05364	-0.94667
4	0.99218	-0.00785	0.07215	-0.92837
5	0.97480	-0.02552	0.07448	-0.92561

OPTIMAL ORDER BY CAT CRITERION IS 0   MAXIMUM ORDER CHECKED IS 5

OPTIMAL ORDER BY AIC CRITERION IS 0   MAXIMUM ORDER CHECKED IS 5

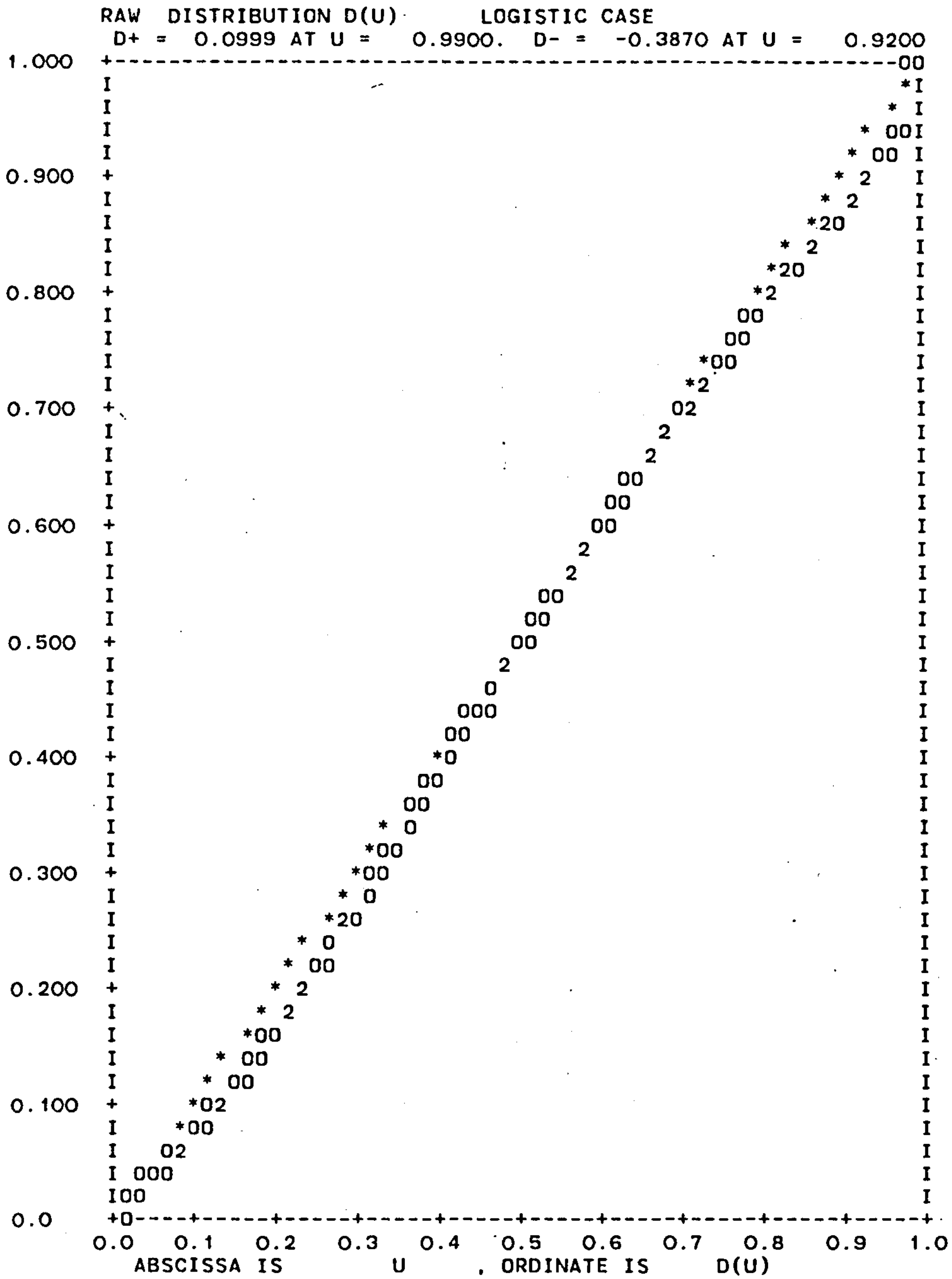
Spring Wheat Pixel Neighborhood Channel 3 Medians: AIC AR order determining analysis.

SEG=1380 YR=1978 DY= 115 CH= 3 GT= 100
INFORMATIVE QUANTILE - LILEAR INTERPOLATION FROM UNGROUPED DATA



<u>Spring Wheat Pixel Neighborhood Channel 3</u>

<u>Mean IQ</u>: IQ plot indicates normality.

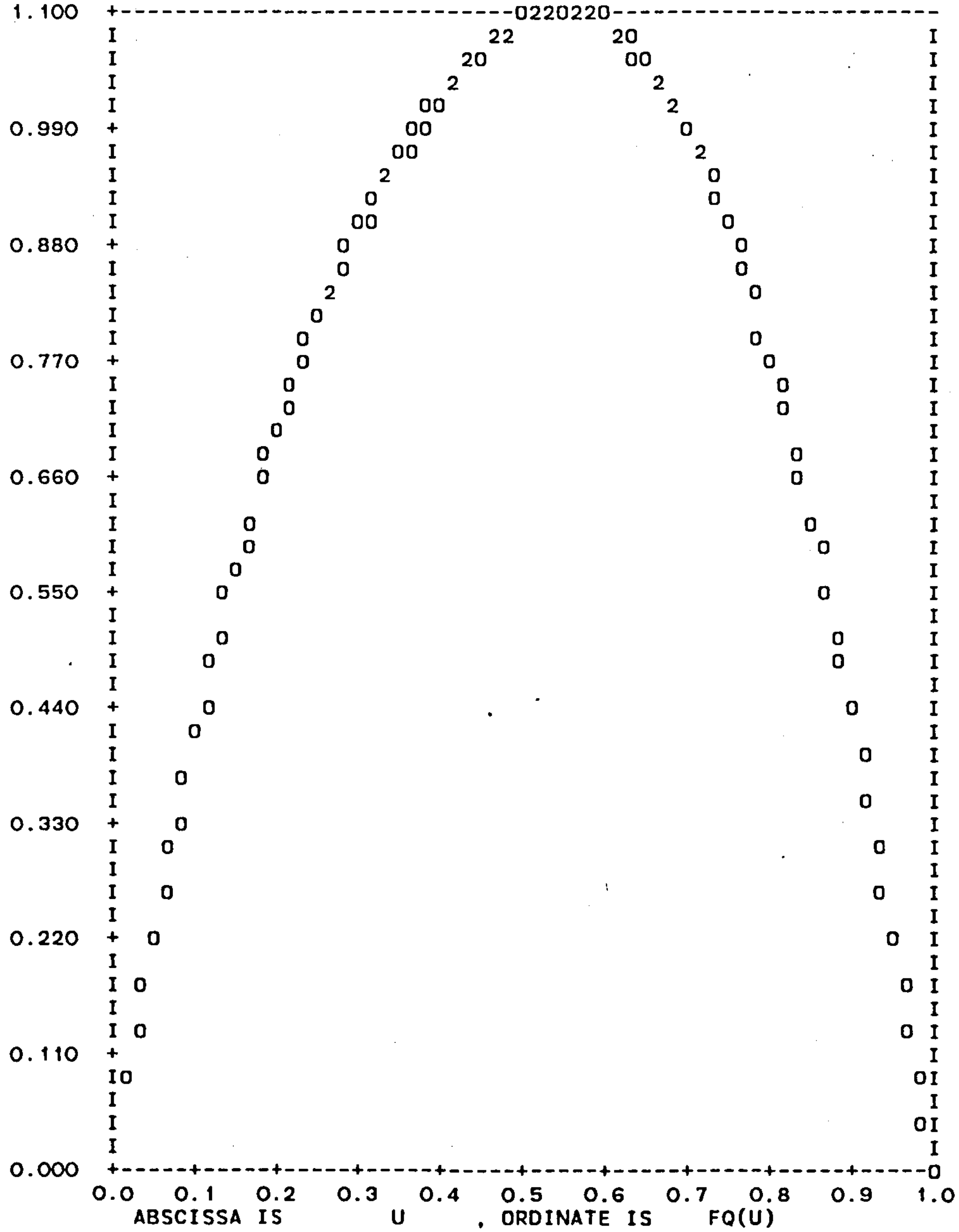


<u>Spring Wheat Pixel Neighborhood Channel 3</u>

<u>Mean IQ</u>: Cumulative weighted spacings D(u) plot indicates accept fit of logistic distribution.

S T A T I S T I C A L   A N A L Y S I S   S Y S T E M   20:12 WEDNESDAY, MAY 18, 1983   178

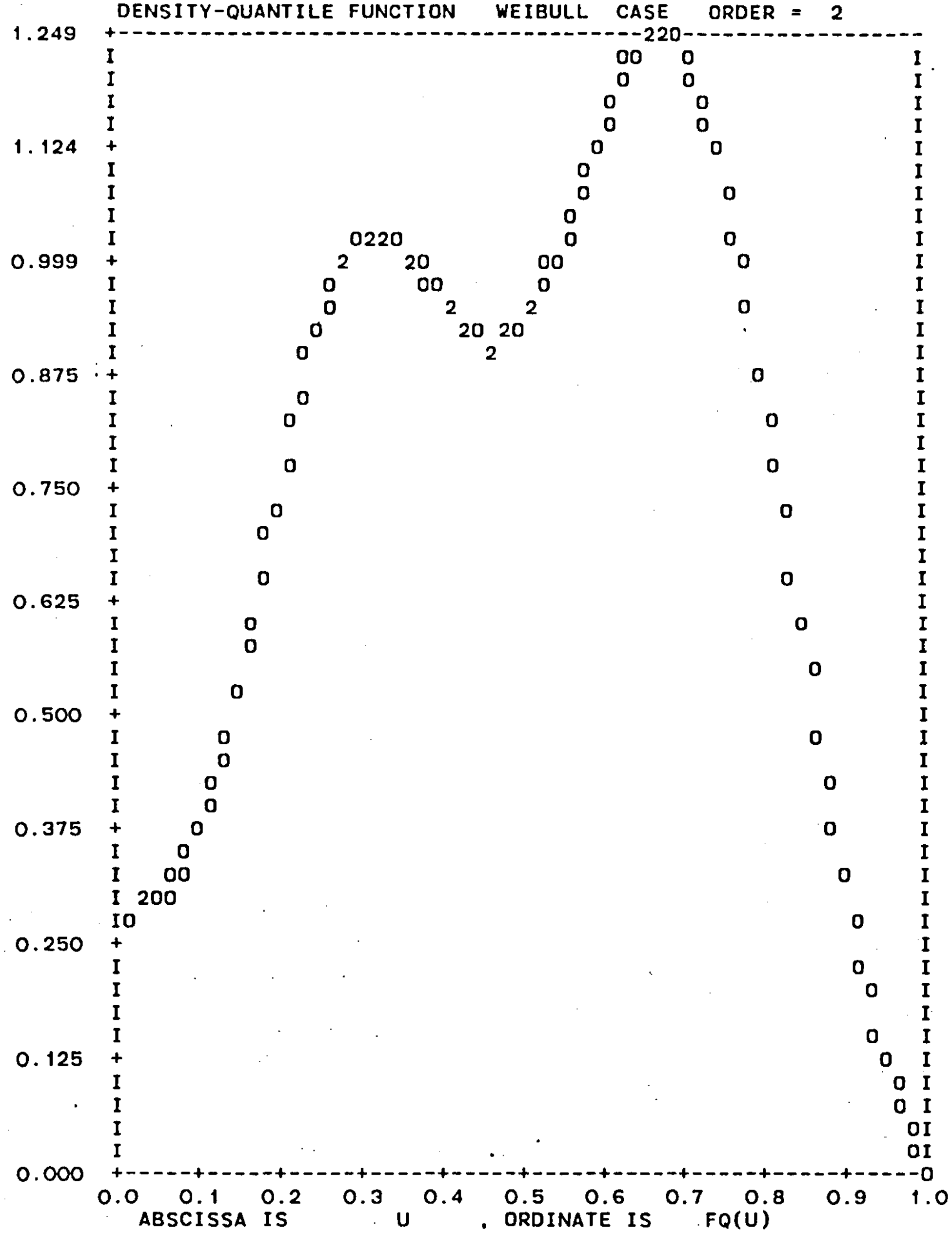
SEG=1380 YR=1978 DY= 115 CH= 3 GT= 100
DENSITY-QUANTILE FUNCTION   LOGISTIC CASE   ORDER = 1



<u>Spring Wheat Pixel Neighborhood Channel 3</u>

<u>Mean IQ</u>: Autoregressive density-quantile estimator (with logistic base and order 1) indicates normal-like density.

SEG=1380 YR=1978 DY= 115 CH= 3 GT= 100
DENSITY-QUANTILE FUNCTION   WEIBULL CASE   ORDER = 2

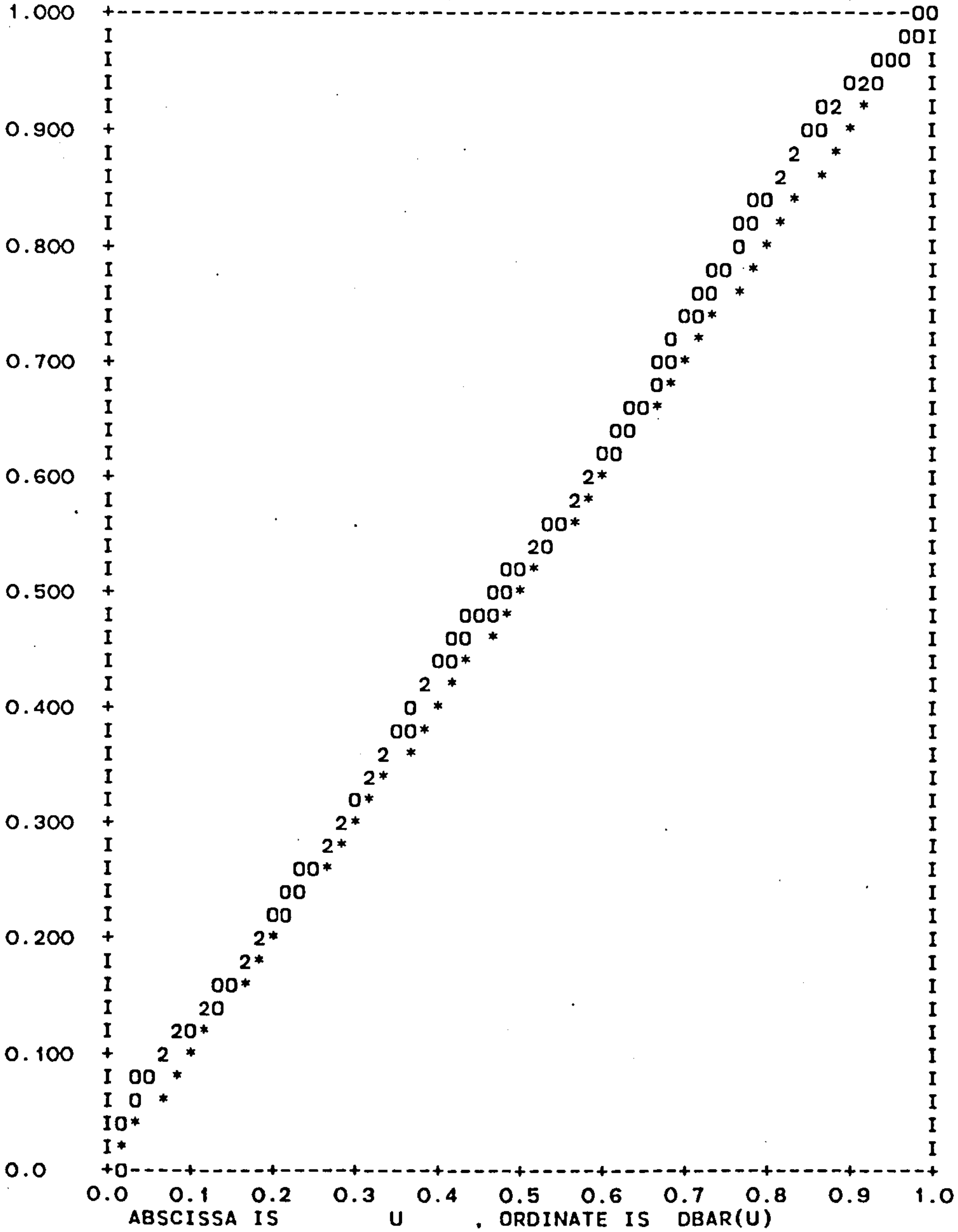


Spring Wheat Pixel Neighborhood Channel 3

Mean IQ: Autoregressive density-quantile estimator (with Weibull base and order 2) indicates a density not in accord with logistic analysis, thus casting doubt on current reliability of AR order determining techniques.

S T A T I S T I C A L   A N A L Y S I S   S Y S T E M   23:45 WEDNESDAY, MAY 18, 1983 179

SEG=1380 YR=1978 DY= 115 CH= 3 GT= 100
DBAR PLOTTED AGAINST D(U)=U (*) WEIBULL CASE ORDER = 2



Spring Wheat Pixel Neighborhood Channel 3

Mean IQ: Diagnostic of fit of AR density-quantile estimator (with Weibull base and order 2) indicates that it "overfits" and might generate spurious modes in the density.

SUMMARY OF AR PARAMETRIC SELECT ANALYSIS FOR WEIBULL CASE

Mean IQ Channel 3

ORDER	RES_VAR	LOG(RES_VAR)	AIC	CAT
1	0.90931	-0.09507	-0.07507	-1.07785
2	0.88209	-0.12546	-0.08546	-1.08899
3	0.86845	-0.14104	-0.08104	-1.08376
4	0.86084	-0.14984	-0.06984	-1.07086
5	0.85631	-0.15512	-0.05512	-1.05400

OPTIMAL ORDER BY CAT CRITERION IS 2   MAXIMUM ORDER CHECKED IS 5

OPTIMAL ORDER BY AIC CRITERION IS 2   MAXIMUM ORDER CHECKED IS 5

SUMMARY OF AR PARAMETRIC SELECT ANALYSIS FOR LOGISTIC CASE

Mean IQ Channel 3

ORDER	RES_VAR	LOG(RES_VAR)	AIC	CAT
1	0.99882	-0.00118	0.01882	-0.98126
2	0.99655	-0.00346	0.03654	-0.96365
3	0.99392	-0.00610	0.05390	-0.94643
4	0.99086	-0.00918	0.07082	-0.92966
5	0.98756	-0.01251	0.08749	-0.91315

OPTIMAL ORDER BY CAT CRITERION IS 0   MAXIMUM ORDER CHECKED IS 5

OPTIMAL ORDER BY AIC CRITERION IS 0   MAXIMUM ORDER CHECKED IS 5

Spring Wheat Pixel Neighborhood Channel 3 Mean IQ: AIC AR order determining analysis.

end *

Appendix: Quantile and FUN.STAT Data Analysis

This appendix presents some of the new characterizations of probability laws which are being developed under the names of quantile data analysis, and functional statistical inference analysis. Estimators of these characteristics are currently available for one sample and two samples, univariate and bivariate [Parzen (1979), (1983), Woodfield (1982)].

These methods seem to have much potential to contribute to the solution of the problem of digital image representation: the determination and modeling of basic characteristics or features of the digital image which can be incorporated into the process of identifying classes and attributes in a scene. They provide new approaches to determining scene probability density functions and class conditional density functions of digital image data in order to understand spectral characteristics and extract desired information. They can provide data representations which reduce the dimensions of multivariate image data while preserving information pertaining to scene classes and attributes.

A. One Sample: Univariate

Let X be continuous random variable of which we observe a random sample. To estimate distribution function $F_X(x) = Pr[X \leq x]$ and probability density $f(x) - F'(x)$, we estimate: quantile function $Q_X(u) = F_X^{-1}(u)$; quantile density $q_X(u) = Q_X'(u)$; density quantile $fQ_X(u) = f_X(Q_X(u))$. A quantile data analysis of the random sample

1. Forms sample distribution function $\tilde{F}_X(x)$, sample quantile function $\tilde{Q}_X(u)$, sample quantile density $\tilde{q}(u)$ at a grid of values of u in $0<u<1$.

2. Plots sample version of informative quantile function

$$IQ(u) = \frac{Q(u)-Q(0.5)}{2\{Q(0.75) - Q(0.25)\}}$$

whose values as u tends to 0 and 1 indicates the tail exponents of the probability law of X.

3. Determines standard distribution functions $F_0(x)$ to test

$$H_0: F(x) = F_0(\frac{x-\mu}{\sigma}) \text{ or } Q(u) = \mu + \sigma Q_0(u)$$

for location and scale parameters μ and σ to be estimated. A test of H_0 which does not require estimation of μ and σ can be based on [Parzen (1979)]

$$\tilde{d}(u) = f_0Q_0(u)\ \tilde{q}(u) \div \tilde{\sigma}_0 \qquad ,$$

$$\tilde{\sigma}_0 = \int_0^1 f_0Q_0(t)\ \tilde{q}(t)\ dt$$

which estimate respectively

$$d(u) = f_0Q_0(u)\ q(u) \div \sigma_0 \qquad ,$$

$$\sigma_0 = \int_0^1 f_0Q_0(t)\ q(t)\ dt.$$

4. Form successive autoregressive estimators

$$\hat{d}_m(u) = \hat{K}_m \left| 1 + \hat{\alpha}_m(1)\ e^{2\pi iu} + \ldots + \hat{\alpha}_m(m)\ e^{2\pi ium} \right|^{-2}$$

whose negentropy

$$\hat{H}_m = \int_0^1 - \log \hat{d}_m(u)\ du = - \log \hat{K}_m$$

is used to determine optimal orders $\hat{m}$. Note that $\hat{H}_m$ estimates the entropy difference

$$\Delta = \{\log \sigma_0 - \int_0^1 \log f_0Q_0(u)\} - \{- \int_0^1 \log fQ(u)\ du\}$$

5. Estimate $fQ(u)$ by

$$\hat{f}Q_m(u) = f_0Q_0(u) \div \tilde{\sigma}_0\ \hat{d}_m(u)$$

where m is chosen equal to an optimal order $\hat{m}$.

B. Two Sample: Univariate

Let X and Y be continuous random variables with random samples $X_1,\ldots,X_m$ and $Y_1,\ldots,Y_n$ respectively, and with respective distribution functions $F(x) = \Pr[X \leq x]$, $G(x) = \Pr[Y \leq x]$. The pooled sample $X_1,\ldots,X_m, Y_1,\ldots,Y_n$ can be regarded as a random sample from the distribution function

$$H(x) = \lambda\ F(x) + (1-\lambda)\ G(x), \qquad \lambda = \frac{m}{m+n} \quad .$$

To test the hypotheses of equality of distributions, H_0: $F(x) = G(x) = H(x)$, it is customary in non-parametric statistics to introduce

$$D_X(u) = F\ H^{-1}(u), \qquad D_Y(u) = G\ H^{-1}(u)$$

with densities [equivalent to likelihood ratios]

$$d_X(u) = \frac{f\ H^{-1}(u)}{f\ H^{-1}(u)} \quad , \qquad d_Y(u) = \frac{g\ H^{-1}(u)}{h\ H^{-1}(u)} \quad .$$

Note that $h\ H^{-1}(u) = \lambda\ f\ H^{-1}(u) + (1-\ \lambda)\ g\ H^{-1}(u)$; therefore

$$d_X(u) = \left\{ \lambda + (1-\lambda)\ \frac{g\ H^{-1}(u)}{f\ H^{-1}(u)} \right\}^{-1} \quad .$$

Parzen (1983) shows that all conventional two-sample nonparametric test procedures are functionals of the following raw estimator of $D_X(u)$:

$$\tilde{D}_X(u) = \{\tilde{H}\ \tilde{F}_X^{-1}\}^{-1}(u)$$

from which one can form "pseudo-correlations" $\tilde{\rho}(\nu)$ and linear rank statistics $\Delta(J)$ with score function $J(u)$,

$$\tilde{\rho}(v) = \int_0^1 e^{2\pi iuv}\, d\, \tilde{D}_X(u) \ , \quad \Delta(J) = \int_0^1 J(u)\ d\tilde{D}_X(u) \quad ,$$

and autoregressive estimators $\hat{d}_{X,m}(u)$ of $d_X(u)$.

When one observes several variables $X^{(1)}, X^{(2)}, \ldots, X^{(j)}, \cdots$ one estimates functionals of $D_j(u) = F_{X^{(j)}}\ (H^{-1}(u))$ or $D_{jk}(u) = F_{X^{(j)}}(F^{-1}_{X^{(k)}}(u))$.

C. <u>One Sample: Bivariate</u>

Let (X_1, X_2) be jointly continuous random variables with distribution function $F_{X_1,X_2}\ (x_1,x_2) = \Pr[X_1 \leq x\ ,\ X_2 \leq x_2]$ and density $f_{X_1,X_2}\ (x_1,x_2)$. The joint density quantile function is defined by

$$fQ_{X_1,X_2}\ (u_1,u_2) = f_{X_1,X_2}\ (Q_{X_1}(u_1),\ Q_{X_2}(u_2)) \quad .$$

To estimate fQ we define

$$D_{X_1,X_2}\ (u_1,u_2) = F_{X_1,X_2}\ (Q_{X_1}(u_1),\ \ Q_{X_2}(u_2))$$

which is the distribution function of $U_1 = F_{X_1}(X_1)$, $U_2 = F_{X_2}(X_2)$; it has density

$$d_{X_1,X_2}(u_1,u_2) = \frac{\partial^2}{\partial u_1 \ \partial u_2} D(u_1,u_2)$$

satisfying

$$fQ_{X_1,X_2}(u_1,u_2) = fQ_{X_1}(u_1)\ fQ_{X_2}(u_2)\ d_{X_1,X_2}(u_1,u_2) \quad .$$

To estimate d_{X_1,X_2} from a random sample $(X_1^{(j)}, X_2^{(j)})$, $j=1,\ldots,n$, form

$$\tilde{D}_{X_1,X_2} = \tilde{F}_{X_1,X_2}(\tilde{Q}_{X_1}(u_1), \tilde{Q}_{X_2}(u_2))$$

and a raw estimator $\hat{d}_{X_1,X_2}(u_1,u_2)$. We smooth $\log \tilde{d}_{X_1,X_2}(u_1,u_2)$ by a smooth estimator $\log \hat{d}_{X_1,X_2}(u_1,u_2)$ minimizing a criterion <u>similar</u> to

$$\sum_{j=1}^{n} \left| \log d[U_1^{(j)},U_2^{(j)}] - \log d_m[U_1^{(j)}, U_2^{(j)}]\right|^2$$

where $\log d_m(u_1,u_2)$ has the parametric representation

$$\log d_m(u_1,u_2) = \sum_{\nu_1,\nu_2} \theta_{\nu_1,\nu_2} \exp i\ (u_1\nu_1 + u_2\nu_2) - \psi(\theta_{\nu_1,\nu_2}) \ ;$$

where the summation is over $\nu_1,\nu_2 = 0, \pm 1,\ldots,\pm m$, and $\psi(\theta_{\nu_1,\nu_2})$ is an integrating factor to make $d_m(u_1,u_2)$ a probability density. The foregoing estimators have been implemented in T. J. Woodfield [1982]. The problem of choosing a best value of the order m is approached by evaluating the entropy of d_m.

D. Two Samples: Bivariate

Let (X_1, X_2) and (Y_1, Y_2) be random vectors with respective distribution functions $F(x_1, x_2)$ and $G(y_1, y_2)$, and respective random samples

$$(X_1,{}^{(j)}X_2{}^{(j)}),\ j=1,\dots,m \quad \text{and} \quad (Y_1{}^{(k)}, Y_2{}^{(k)}),\ k=1,2,\dots,n.$$

Let $H(x_1, x_2)$ denote the distribution function of the pooled random sample, with marginal distribution functions $H_1(x_1)$ and $H_2(x_2)$. Define

$$D_1(u_1,u_2) = F(H_1^{-1}(u_1),\ H_2^{-1}(u_2)) \quad ,$$

$$D_2(u_1,u_2) = F(H_1^{-1}(u_1),\ H_2^{-1}(u_2)) \quad .$$

From $D_1(u_1,u_2)$ and $D_2(u_1,u_2)$ one can form raw estimators $d_1(u_1,u_2)$ and $d_2(u_1,u_2)$ of the densities

$$d_1(u_1,u_2) = \frac{f(H_1^{-1}(u_1),\ H_2^{-1}(u_2))}{h_1H_1^{-1}(u_1)\ h_2H_2^{-1}(u_2)} \quad ,$$

$$d_2(u_1,u_2) = \frac{g(H_1^{-1}(u_1),\ H_2^{-1}(u_2))}{h_1H_1^{-1}(u_1)\ h_2H_2^{-1}(u)} \quad .$$

Therefore

$$\log d_1(u_1,u_2) - \log d_2(u_1,u_2)$$

$$= \log f(H_1^{-1}(u_1),\ H_2^{-1}(u_2)) - \log g(H_1^{-1}(u_1),\ H_2^{-1}(u_2)) \quad .$$

The likelihood ratio $f(x_1,x_2)/g(x_1,x_2)$ can be effectively estimated by estimating $\log d_1(u_1,u_2) - \log d_2(u_1,u_2)$. It seems most natural to estimate [using exponential model representations]

$$\log d_1(u_1,u_2) - \log d_{11}(u_1) - \log d_{12}(u_2)$$

where $d_{11}(u_1)$ and $d_{12}(u_2)$ are the marginal densities of $d_1(u_1,u_2)$ which are estimated separately by methods of two samples: univariate.

The final output are contour plots of the classification statistic

$$L(x_1,x_2) = \log f(x_1,x_2) - \log g(x_1,x_2) \quad .$$

A point (x_1,x_2) is classified in population 1 or 2 by whether $L(x_1,x_2)$ exceeds a threshold which depends on the prior probabilities and loss function.

Appendix: Exploratory Quantile Data Analysis of Training Files

The basic tool for determining statistical characteristics that are good discriminators is to determine (for each file, ground truth, and channel) a data batch of measurements in the specified channel on all pixels with the specified ground truth. The statistical characteristics of these data batches are summarized (as on the attached pages) and studied to determine patterns which can discriminate between different ground truths. The file numbers are those used in the Fundamental Research Data Base [see Guseman (1983)].

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OBS	FILE_NO	CHANNEL	GR_TRUTH	SMPL_SIZ	Q_25	Q_50	Q_75	IQ_R	MEAN_IQ	STD_IQ	IQ_01	IQ_99	LOG_SPC	LOG_WSPC	LOG_FOQO	SIGMA_O	LOG_SIGO	LG_SO_WS
1	1	2	90	377	15.000	19	24.0000	9.0000	0.08564	0.322475	-0.3456	1.05556	-1.3536	-1.5800	-0.90686	0.50636	-0.68050	.
2	1	2	92	8755	14.000	15	19.0000	5.0000	0.17327	0.442017	-0.4000	2.80000	0.1066	-0.5821	-0.90812	0.80297	-0.21943	.
3	1	2	97	10573	14.000	15	19.0000	5.0000	0.17437	0.463493	-0.4000	2.70000	-1.3959	-1.8841	-0.90812	0.65714	-0.41986	.
4	1	2	98	793	13.000	14	17.0000	4.0000	0.14415	0.416479	-0.3750	2.25000	-1.1693	-1.5917	-0.90686	0.61600	-0.48451	.
5	1	2	100	2296	15.000	18	21.0000	6.0000	0.07333	0.448731	-0.5833	2.08333	0.0933	-0.6163	-0.90686	0.82098	-0.19726	.
6	1	2	104	558	15.000	18	23.0000	8.0000	0.09492	0.382529	-0.4375	1.18750	-2.0936	-2.4581	-0.90812	0.58059	-0.54370	.
7	1	2	111	174	19.000	23	27.0000	8.0000	-0.01331	0.326849	-0.7500	0.81250	-5.1738	-5.5843	-0.90812	0.60793	-0.49770	.
8	1	2	113	248	19.000	21	24.0000	5.0000	-0.00419	0.407626	-1.0000	1.10000	-1.5537	-2.3137	-0.90812	0.86235	-0.14809	.
9	1	2	114	95	18.000	20	24.0000	6.0000	0.08244	0.381941	-0.7500	1.00000	-1.8184	-2.3698	-0.90812	0.69993	-0.35677	.
10	1	2	164	2980	15.000	19	22.0000	7.0000	0.00592	0.373707	-0.5714	1.50000	-0.0626	-0.6454	-0.90812	0.72225	-0.32539	.
11	1	2	242	1326	15.000	19	21.0000	6.0000	-0.00299	0.367563	-0.6667	1.58333	-0.0152	-0.6651	-0.90812	0.77239	-0.25827	.
12	1	3	90	377	14.000	20	30.7500	16.7500	0.07147	0.274792	-0.3284	0.68657	-1.0524	-1.1649	-0.90686	0.45186	-0.79437	.
13	1	3	92	8755	11.500	14	18.0000	6.5000	0.09520	0.506777	-0.4615	3.00000	0.1017	-0.5798	-0.90812	0.79720	-0.22665	.
14	1	3	97	10573	10.000	13	18.0000	8.0000	0.13187	0.407418	-0.3125	1.93750	-0.1479	-0.6297	-0.90812	0.65293	-0.42629	.
15	1	3	98	793	9.500	12	14.0000	4.5000	0.06506	0.492558	-0.4444	2.55556	-0.6937	-1.3238	-0.90812	0.75730	-0.27800	.
16	1	3	100	2296	12.500	16	21.5000	9.0000	0.11257	0.407630	-0.4444	1.66667	-0.5910	-1.0575	-0.90812	0.64299	-0.44162	.
17	1	3	104	558	13.000	16	24.0000	11.0000	0.11668	0.345959	-0.3636	1.00000	-0.8114	-1.1307	-0.90812	0.55493	-0.58891	.
18	1	3	111	174	20.500	26	33.0000	12.5000	0.02218	0.339094	-0.7200	0.68000	-3.7113	-4.1667	-0.90812	0.63589	-0.45273	.
19	1	3	113	248	20.000	28	33.0000	13.0000	-0.05665	0.319116	-0.7692	0.65385	-1.3456	-1.8080	-0.90812	0.64040	-0.44567	.
20	1	3	114	95	18.000	24	29.0000	11.0000	-0.01359	0.347879	-0.7273	0.68182	-4.1139	-4.6001	-0.90812	0.65577	-0.42194	.
21	1	3	164	2980	13.000	18	24.0000	11.0000	0.05420	0.367705	-0.4545	1.40909	-0.5273	-0.9115	-0.90812	0.59221	-0.52390	.
22	1	3	242	1326	14.500	20	26.0000	11.5000	0.03849	0.350681	-0.5217	1.43478	-2.1322	-2.4893	-0.90812	0.57637	-0.55101	.
23	6	2	19	84	26.000	27	29.0000	3.0000	0.10974	0.422269	-0.8333	1.33333	-7.7867	-8.4229	-0.90686	0.76287	-0.27066	.
24	6	2	20	84	24.025	27	28.9375	4.9125	-0.02021	0.313054	-0.5089	1.01781	-7.0616	-7.3181	-0.90686	0.52187	-0.65034	.
25	6	2	21	68	26.780	27	29.0000	2.2200	0.30070	0.676187	-1.1261	2.25224	-6.9264	-7.9460	-0.90812	1.11795	0.11149	.
26	6	2	22	138	26.000	28	30.0000	4.0000	0.05138	0.400085	-0.7500	1.12500	-7.2153	-7.9296	-0.90812	0.82389	-0.19372	.
27	6	2	24	75	29.000	30	33.0000	4.0000	0.08499	0.314726	-1.0000	0.75000	-7.9774	-8.4502	-0.90812	0.64713	-0.43521	.
28	6	2	25	98	31.880	33	36.0000	4.1200	0.02669	0.411211	-1.3349	0.84951	-7.2732	-8.1135	-0.90812	0.93442	-0.06783	.
29	6	2	26	59	28.700	29	32.0000	3.3000	0.08760	0.436342	-1.0606	1.06059	-6.8373	-7.6235	-0.90812	0.88522	-0.12192	.
30	6	2	27	66	29.000	29	31.0000	2.0000	0.17336	0.514212	-1.7500	1.50000	-7.3150	-8.3163	-0.90812	1.09776	0.09327	.
31	6	2	29	90	26.920	29	30.0000	3.0800	-0.14964	0.638682	-1.1364	1.13636	-5.8349	-7.1081	-0.90812	1.44067	0.36511	.
32	6	2	30	147	30.000	33	36.0000	6.0000	-0.00780	0.289214	-0.9167	0.66667	-7.0916	-7.5682	-0.90686	0.65036	-0.43023	.
33	6	2	80	262	29.000	33	35.0000	6.0000	-0.10390	0.357624	-0.9167	0.58333	-1.7481	-2.5181	-0.90812	0.87100	-0.13811	.
34	6	2	90	110	27.000	29	31.0000	4.0000	0.04559	0.376118	-0.8750	1.12500	-7.0515	-7.5858	-0.90812	0.68816	-0.37374	.
35	6	2	92	70	30.000	32	33.0000	3.0000	-0.07507	0.374930	-1.6667	0.50000	-8.1278	-8.8591	-0.90812	0.83789	-0.17687	.
36	6	2	94	719	29.000	31	33.0000	4.0000	0.03415	0.538090	-1.1250	1.62500	-4.4185	-5.5421	-0.90812	1.24040	0.21543	.
37	6	2	95	802	29.000	30	33.0000	4.0000	0.09802	0.471782	-1.0000	1.50000	-0.4534	-1.3925	-0.90812	1.03154	0.03105	.
38	6	2	100	7449	29.000	31	33.0000	4.0000	0.00000	0.435172	-1.1250	1.37500	0.2642	-0.7829	-0.90812	1.14906	0.13894	.
39	6	2	101	667	29.000	32	34.0000	5.0000	-0.04075	0.413778	-1.0000	1.40000	-0.3265	-1.1803	-0.90812	0.94716	-0.05429	.
40	6	2	103	166	29.000	33	35.0000	6.0000	-0.09408	0.388473	-0.9167	0.75000	-6.3937	-7.0892	-0.90812	0.80842	-0.21268	.
41	6	2	104	286	29.000	30	33.0000	4.0000	0.07518	0.449739	-1.0000	1.25000	-0.6947	-1.7583	-0.90812	1.16820	0.15547	.
42	6	2	111	3033	27.500	30	33.0000	5.5000	-0.05079	0.472771	-0.7273	1.09091	-0.2712	-1.3387	-0.90812	1.17272	0.15933	.
43	6	2	112	52	29.000	30	32.0000	3.0000	-0.01842	0.545337	-1.3333	1.33333	-6.3356	-7.4244	-0.90812	1.19797	0.18063	.
44	6	2	164	3344	28.000	30	33.0000	5.0000	0.04901	0.460380	-0.8000	2.10000	-0.3333	-1.2640	-0.90812	1.02287	0.02262	.
45	6	2	240	581	15.000	20	29.0000	14.0000	0.06107	0.257827	0.0714	0.78571	-1.3245	-1.3068	-0.90812	0.39618	-0.92590	.
46	6	2	242	1724	25.000	29	33.0000	8.0000	-0.02228	0.402009	-0.4375	0.81250	0.0246	-0.8394	-0.90812	0.95689	-0.04407	.
47	6	2	250	430	29.000	32	33.0000	4.0000	-0.10988	0.482274	-1.2500	1.87500	-0.7696	-1.6981	-0.90812	1.02054	0.02033	.
48	6	3	19	84	25.000	26	29.0000	4.0000	0.15562	0.428386	-0.5000	1.12500	-7.5269	-8.0800	-0.90686	0.70208	-0.35371	.
49	6	3	20	84	23.000	26	29.0000	6.0000	0.09133	0.417561	-0.3333	1.25000	-6.1938	-6.6268	-0.90812	0.62182	-0.47511	.

OBS	FILE_NO	CHANNEL	GR_TRUTH	SMPL_SIZ	Q_25	Q_50	Q_75	IQ_R	MEAN_IQ	STD_IQ	IQ_01	IQ_99	LOG_SPC	LOG_WSPC	LOG_FOQO	SIGMA_O	LOG_SIGO	LG_SO_WS
50	6	3	21	68	28.000	28.0000	30.0000	2.0000	0.27126	0.704507	-1.5000	2.00000	-6.2044	-7.4344	-0.90686	1.38154	0.32320	.
51	6	3	22	138	26.000	29.0000	31.0000	5.0000	-0.06978	0.379523	-0.7000	0.70000	-2.1660	-2.9263	-0.90812	0.86258	-0.14783	.
52	6	3	24	75	29.000	32.0000	33.0000	4.0000	-0.10535	0.368432	-1.2500	0.62501	-7.1877	-7.8403	-0.90812	0.77452	-0.25551	.
53	6	3	25	98	32.880	34.0000	36.0000	3.1200	0.02724	0.504708	-1.9231	0.96153	-1.4831	-2.5190	-0.90812	1.13631	0.12779	.
54	6	3	26	59	32.000	34.0000	39.4499	7.4500	0.06483	0.372958	-0.8054	0.87249	-4.6571	-5.2885	-0.90686	0.75918	-0.27551	.
55	6	3	27	66	28.000	29.0000	31.5849	3.5849	0.10743	0.357394	-0.9763	0.83684	-7.1108	-7.7215	-0.90812	0.74273	-0.29742	.
56	6	3	29	90	25.375	29.0000	33.0000	7.6250	0.00003	0.375881	-0.4590	0.78688	-1.6667	-2.3720	-0.90812	0.81641	-0.20284	.
57	6	3	30	147	32.000	34.0000	36.9999	4.9999	-0.01149	0.378298	-1.2000	0.70001	-5.5537	-6.3597	-0.90812	0.90293	-0.10211	.
58	6	3	80	262	31.000	35.4999	38.0000	7.0000	-0.08160	0.412245	-0.9643	0.75001	-1.5098	-2.4394	-0.90812	1.02177	0.02154	.
59	6	3	90	110	35.000	37.0000	39.1799	4.1799	-0.00605	0.457698	-1.7943	1.07657	-6.1105	-7.1068	-0.90812	1.09219	0.08818	.
60	6	3	92	70	33.000	34.5000	36.0000	3.0000	0.01198	0.453114	-2.0833	1.41667	-7.3690	-8.3061	-0.90812	1.02944	0.02901	.
61	6	3	94	719	32.000	35.0000	37.0000	5.0000	-0.07525	0.529481	-1.3000	1.20000	-4.9297	-6.1265	-0.90812	1.33465	0.28867	.
62	6	3	95	802	29.000	32.0000	36.5000	7.5000	0.04627	0.390512	-0.6667	1.13333	-0.4756	-1.0958	-0.90812	0.74982	-0.28793	.
63	6	3	100	7449	29.000	33.0000	36.0000	7.0000	-0.01981	0.343015	-0.7857	1.42857	-0.0980	-0.7663	-0.90812	0.78671	-0.23990	.
64	6	3	101	667	31.000	34.0000	37.0000	6.0000	0.00871	0.441873	-1.0000	1.16667	-0.9997	-1.8437	-0.90812	0.93786	-0.06415	.
65	6	3	103	166	29.000	33.0000	36.0000	7.0000	-0.04188	0.368805	-0.7857	0.71429	-2.2483	-2.9266	-0.90812	0.79469	-0.22981	.
66	6	3	104	286	29.500	32.0000	35.0000	5.5000	-0.02102	0.403830	-0.9091	0.90909	-6.8991	-7.7758	-0.90812	0.96907	-0.03142	.
67	6	3	111	3033	30.000	34.0000	37.0000	7.0000	-0.08816	0.522955	-0.8571	1.28571	0.2503	-0.9520	-0.90812	1.34200	0.29416	.
68	6	3	112	52	36.000	40.0000	44.0000	8.0000	-0.04710	0.376295	-1.1250	0.43750	-1.3283	-2.1256	-0.90686	0.89624	-0.10955	.
69	6	3	164	3344	29.000	33.0000	36.0000	7.0000	-0.02656	0.429949	-0.7857	1.85714	0.0516	-0.8871	-0.90812	1.03101	0.03054	.
70	6	3	240	581	10.000	18.0000	29.7498	19.7498	0.05451	0.268453	0.1013	0.70887	-1.4929	-1.4949	-0.90812	0.40409	-0.90613	.
71	6	3	242	1724	25.500	32.0000	36.0000	10.5000	-0.08133	0.404946	-0.4762	0.90476	-3.2287	-4.0342	-0.90812	0.90245	-0.10264	.
72	6	3	250	430	34.000	37.0000	41.5000	7.5000	0.03987	0.398162	-1.0000	1.06667	-1.6581	-2.4186	-0.90812	0.86273	-0.14766	.
73	11	2	2	97	38.000	40.0000	42.0000	4.0000	0.09039	0.419874	-0.6250	1.75000	-7.3856	-7.9428	-0.90686	0.70493	-0.34966	.
74	11	2	3	59	40.000	42.0000	44.0000	4.0000	-0.00626	0.363281	-0.8750	1.00000	-7.0617	-7.6737	-0.90686	0.74464	-0.29486	.
75	11	2	11	112	38.000	40.0000	40.9375	2.9375	-0.04870	0.314599	-0.8511	0.68086	-8.3158	-8.8274	-0.90686	0.67351	-0.39526	.
76	11	2	14	68	38.000	40.0000	42.0000	4.0000	0.01268	0.309138	-0.6250	0.62500	-8.1677	-8.6187	-0.90812	0.63311	-0.45711	.
77	11	2	15	154	37.000	38.0000	39.0000	2.0000	-0.05372	0.460384	-0.7500	1.00000	-8.3292	-9.3228	-0.90812	1.08931	0.08555	.
78	11	2	16	176	35.000	37.0000	40.0000	5.0000	-0.00641	0.352234	-0.2000	0.80000	-1.4149	-2.0477	-0.90812	0.75936	-0.27529	.
79	11	2	20	89	34.000	35.0000	38.0000	4.0000	0.10804	0.419158	0.0000	1.25000	-6.8548	-7.4064	-0.90812	0.70017	-0.35644	.
80	11	2	21	61	34.000	35.0000	35.0000	1.0000	-0.16516	0.970326	0.0000	2.49996	-6.7873	-8.3991	-0.90812	2.02124	0.70371	.
81	11	2	22	187	35.000	36.0000	38.0000	3.0000	0.12541	0.518729	-0.1667	3.00000	-1.4564	-2.1781	-0.90812	0.82991	-0.18644	.
82	11	2	23	276	40.000	41.0000	42.0000	2.0000	-0.02924	0.511546	-1.5000	1.50000	-7.8764	-8.9025	-0.90812	1.12527	0.11802	.
83	11	2	27	184	35.000	37.0000	38.0000	3.0000	-0.10586	0.363504	-0.3333	1.00000	-1.1591	-1.8038	-0.90812	0.76842	-0.26342	.
84	11	2	80	327	35.000	37.0000	38.0000	3.0000	-0.03545	0.467447	-0.3333	1.33333	-1.8450	-2.7436	-0.90812	0.99053	-0.00952	.
85	11	2	90	137	32.000	35.0000	38.0000	6.0000	-0.03985	0.376386	0.0000	0.58333	-6.5088	-7.3084	-0.90812	0.89714	-0.10855	.
86	11	2	99	1268	38.000	40.0000	42.0000	4.0000	0.00589	0.548328	-0.6250	2.62500	0.1869	-0.8899	-0.90812	1.18372	0.16866	.
87	11	2	100	1258	32.000	33.0000	35.0000	3.0000	0.12269	0.614127	0.3333	2.00000	-1.1158	-2.4396	-0.90812	1.51549	0.41574	.
88	11	2	101	908	36.000	38.0000	41.0000	5.0000	0.02581	0.477375	-0.3000	1.30000	-2.6301	-3.7291	-0.90812	1.21036	0.19092	.
89	11	2	104	145	22.000	30.0000	35.0000	13.0000	-0.00894	0.271717	0.1923	0.65385	-6.4074	-6.4934	-0.90812	0.43950	-0.82211	.
90	11	2	105	1215	30.500	33.0000	36.0000	5.5000	0.12760	0.647085	0.1818	5.36363	-0.5111	-1.1246	-0.90812	0.74478	-0.29467	.
91	11	2	107	12998	30.000	32.0000	36.5000	6.5000	0.19345	0.565437	0.2308	4.69231	-0.0432	-0.6174	-0.90812	0.71613	-0.33389	.
92	11	2	175	804	36.000	38.0000	40.0000	4.0000	0.01380	0.362123	-0.3750	1.12500	-0.4216	-1.1079	-0.90812	0.80097	-0.22193	.
93	11	2	176	75	40.000	40.0000	42.0000	2.0000	0.17919	0.557002	-1.2500	1.75000	-6.9107	-7.9306	-0.90686	1.11974	0.11310	.
94	11	2	179	248	40.000	41.0000	42.0000	2.0000	0.00876	0.672536	-1.5000	1.50000	-1.5916	-2.8273	-0.90812	1.38751	0.32751	.
95	11	2	240	813	35.000	38.0000	50.0000	15.0000	0.15651	0.383497	-0.1000	1.46667	-0.3297	-0.7312	-0.90812	0.60252	-0.50664	.
96	11	3	2	97	44.000	46.0000	48.3599	4.3599	-0.05873	0.461914	-1.1468	0.80276	-6.7082	-7.6067	-0.90686	0.99164	-0.00839	.
97	11	3	3	59	41.700	44.0000	46.0000	4.3000	0.00828	0.362519	-0.9302	0.81395	-7.4606	-8.0711	-0.90686	0.74262	-0.29757	.
98	11	3	11	112	41.000	43.0000	44.8750	3.8750	-0.04080	0.373627	-0.9032	0.90324	-7.7439	-8.3910	-0.90812	0.77026	-0.26103	.

OBS	FILE_NO	CHANNEL	GR_TRUTH	SMPL_SIZ	Q_25	Q_50	Q_75	I_Q_R	MEAN_IQ
99	11	3	14	68	41.0000	44.5000	48.7499	7.7499	0.00934
100	11	3	15	154	41.0000	42.0000	44.0000	3.0000	-0.01168
101	11	3	16	176	35.0000	37.0000	39.0000	4.0000	0.04833
102	11	3	20	89	35.0000	37.0000	39.0000	4.0000	0.08762
103	11	3	21	61	36.0000	37.0000	39.0000	3.0000	0.10095
104	11	3	22	187	36.0000	38.0000	39.0000	3.0000	0.10243
105	11	3	23	276	41.0000	42.0000	44.0000	3.0000	0.07719
106	11	3	27	184	37.0000	38.0000	39.0000	2.0000	-0.05223
107	11	3	80	327	38.0000	39.0000	41.0000	3.0000	0.09934
108	11	3	90	137	38.0000	41.0000	44.0000	6.0000	-0.08112
109	11	3	99	1268	42.0000	45.0000	47.0000	5.0000	0.00174
110	11	3	100	1258	34.0000	35.0000	37.0000	3.0000	0.11312
111	11	3	101	908	37.0000	39.0000	44.0000	7.0000	0.07129
112	11	3	104	145	22.0000	29.0000	37.0000	15.0000	0.02661
113	11	3	105	1215	38.0000	39.0000	44.0000	6.0000	0.19637
114	11	3	107	12998	35.0000	37.0000	41.0000	6.0000	0.14851
115	11	3	175	804	38.0000	39.0000	42.0000	4.0000	0.15476
116	11	3	176	75	39.0000	42.0000	44.5699	5.5699	0.01077
117	11	3	179	248	41.0000	44.0000	45.0000	4.0000	-0.13473
118	11	3	240	813	37.0000	41.0000	49.8197	12.8197	0.12388
119	2	2	90	377	18.0000	22.0000	26.7500	8.7500	0.01643
120	2	2	92	8755	17.0000	19.0000	21.0000	4.0000	0.08750
121	2	2	97	10573	18.0000	20.0000	24.0000	6.0000	0.10750
122	2	2	98	793	19.0000	20.0000	23.0000	4.0000	0.21854
123	2	2	100	2296	15.0000	18.0000	21.0000	6.0000	0.07270
124	2	2	104	558	14.0000	15.0000	18.0000	4.0000	0.15617

OBS	STD_IQ	IQ_01	IQ_99	LOG_SPC	LOG_WSPC	LOG_FOQO	SIGMA_O	LOG_SIGO	LG_SO_WS
99	0.235690	-0.5484	0.35484	-8.2709	-8.3490	-0.90812	0.43605	-0.83000	.
100	0.388799	-1.0000	0.83333	-8.6831	-9.3572	-0.90686	0.79239	-0.23270	.
101	0.485654	-0.1250	1.25000	-1.5900	-2.5285	-0.90812	1.03079	0.03032	.
102	0.389348	-0.1250	1.25000	-7.2055	-7.6596	-0.90812	0.63511	-0.45395	.
103	0.412752	-0.1667	1.16667	-7.0332	-7.6502	-0.90812	0.74746	-0.29108	.
104	0.758390	-0.3333	4.50000	-6.4167	-7.3487	-0.90812	1.02421	0.02393	.
105	0.435878	-0.8333	1.33333	-8.1175	-8.8666	-0.90686	0.85400	-0.15782	.
106	0.529777	-0.5000	1.75000	-7.8936	-8.9375	-0.90812	1.14551	0.13585	.
107	0.438788	-0.5000	1.66667	-2.0614	-2.8461	-0.90812	0.88397	-0.12333	.
108	0.449681	-0.4167	0.50000	-2.1215	-3.1952	-0.90812	1.18011	0.16561	.
109	0.453383	-0.9000	2.00000	0.1700	-0.7820	-0.90812	1.04488	0.04391	.
110	0.683917	0.1667	2.00000	-1.0996	-2.6160	-0.90812	1.83730	0.60830	.
111	0.377377	-0.2143	0.92857	-1.1503	-2.0485	-0.90812	0.99014	-0.00991	.
112	0.278329	0.2333	0.63333	-1.4291	-1.5725	-0.90812	0.46546	-0.76473	.
113	0.587574	-0.2500	4.83333	0.0025	-0.7074	-0.90812	0.82017	-0.19824	.
114	0.566747	-0.0833	4.58333	0.0080	-0.6664	-0.90812	0.79156	-0.23375	.
115	0.427600	-0.3750	1.75000	0.0988	-0.7925	-0.90812	0.98332	-0.01682	.
116	0.286119	-0.5386	0.89768	-7.8258	-8.0574	-0.90686	0.50897	-0.67536	.
117	0.441134	-1.0000	0.87500	-7.2207	-7.9961	-0.90812	0.87576	-0.13266	.
118	0.415452	-0.1950	1.67711	-0.6044	-1.1408	-0.90812	0.68958	-0.37167	.
119	0.343387	-0.5269	1.20000	-0.9547	-1.3491	.	0.59900	-0.51249	0.83658
120	0.572547	-0.6250	3.37500	0.3307	-0.6199	.	1.04465	0.04368	0.66354
121	0.442594	-0.5000	2.33333	0.0775	-0.6228	.	0.81336	-0.20658	0.41624
122	0.712776	-0.7500	4.25000	-0.3916	-1.2954	.	0.99698	-0.00303	1.29241
123	0.457327	-0.5025	2.33333	-0.1113	-0.7367	.	0.75462	-0.28154	0.45512
124	0.513247	-0.5000	3.12500	-1.7848	-2.2800	.	0.66252	-0.41170	1.86825

OBS	FILE_NO	CHANNEL	GR_TRUTH	SMPL_SIZ	Q_25	Q_50	Q_75	I_Q_R	MEAN_I_Q	STD_I_Q	IQ_01	IQ_99	LOG_SPC	LOG_WSPC	LOG_FOOO	SIGMA_O	LOG_SIGO	LG_SO_WS
125	2	2	111	174	15.0000	17.0000	19.0000	4.0000	0.029684	0.42386	-0.5313	1.8750	-6.3085	-6.7216	.	0.610	-0.49383	6.22773
126	2	2	113	248	19.0000	20.0000	23.0000	4.0000	0.096609	0.51549	-0.7500	2.2500	-2.1118	-2.8814	.	0.872	-0.13723	2.74415
127	2	2	114	95	14.0000	15.0000	19.7199	5.7199	0.135383	0.38424	-0.4371	1.5734	-1.9182	-2.2945	.	0.588	-0.53050	1.76402
128	2	2	164	2980	18.0000	20.0000	23.7500	5.7500	0.092174	0.52215	-0.6957	3.0435	0.2152	-0.6131	.	0.924	-0.07856	0.53450
129	2	2	242	1326	17.2500	20.0000	24.0000	6.7500	0.062222	0.39022	-0.5926	1.4815	0.0099	-0.6459	.	0.778	-0.25107	0.39487
130	2	3	90	377	33.0000	43.0000	53.7500	20.7500	0.059363	0.39547	-0.5354	1.2048	-0.3070	-0.7531	.	0.631	-0.46080	0.29229
131	2	3	92	8755	24.0000	29.5000	35.7500	11.7500	0.095745	0.49171	-0.5319	2.7021	0.0642	-0.5198	.	0.724	-0.32282	0.19700
132	2	3	97	10573	24.0000	30.0000	36.7500	12.7500	0.082013	0.45035	-0.5490	2.2745	-0.7583	-1.2533	.	0.662	-0.41184	0.84146
133	2	3	98	793	27.0000	31.0000	36.0000	9.0000	0.087718	0.47173	-0.6700	1.8889	-1.2208	-1.8513	.	0.759	-0.27636	1.57490
134	2	3	100	2296	40.0000	50.5000	59.0000	19.0000	-0.012375	0.36361	-0.7771	0.9868	-0.0037	-0.6066	.	0.738	-0.30399	0.30257
135	2	3	104	558	45.0000	55.0448	65.7500	20.7500	-0.035356	0.35698	-0.8445	0.7218	-0.5098	-1.1162	.	0.741	-0.30040	0.81584
136	2	3	111	174	45.8125	50.1250	56.0000	10.1875	0.024783	0.48401	-1.1227	1.2699	-2.9237	-3.8349	.	1.004	0.00429	3.83915
137	2	3	113	248	38.2500	47.0000	52.0000	13.7500	-0.054036	0.36826	-0.9640	0.9091	-0.7254	-1.4139	.	0.804	-0.21832	1.19561
138	2	3	114	95	43.2400	49.0000	56.0000	12.7600	0.002850	0.45506	-1.0580	1.2931	-2.3053	-3.1337	.	0.925	-0.07845	3.05528
139	2	3	164	2980	26.0148	35.0000	47.0000	20.9852	0.062615	0.32554	-0.4289	1.3104	-0.7642	-1.0185	.	0.521	-0.65263	0.36583
140	2	3	242	1326	36.0000	46.0000	54.0000	18.0000	-0.024542	0.33170	-0.7222	1.0000	-0.3208	-0.7943	.	0.648	-0.43342	0.36083
141	3	2	90	377	12.0000	14.0000	16.0000	4.0000	0.019298	0.39258	-0.6250	1.6250	-1.4727	-1.9344	.	0.641	-0.44521	1.48915
142	3	2	92	8755	11.0000	11.0000	13.0000	2.0000	0.350000	0.93136	-0.5000	7.7500	0.7991	-0.4952	.	1.473	0.38740	0.88257
143	3	2	97	10573	11.0000	13.0000	15.0000	4.0000	0.065000	0.47157	-0.5000	3.5000	0.1337	-0.5785	.	0.823	-0.19460	0.38393
144	3	2	98	793	13.0000	14.0000	15.0000	2.0000	0.096596	0.57447	-0.7500	3.7500	0.0860	-0.9220	.	1.106	0.10108	1.02305
145	3	2	100	2296	12.0000	14.0000	16.0000	4.0000	0.043784	0.42661	-0.5000	3.1250	0.1147	-0.6083	.	0.832	-0.18377	0.42457
146	3	2	104	558	12.0000	14.0000	15.8124	3.8124	0.022792	0.37163	-0.5246	2.0984	-1.2114	-1.6041	.	0.598	-0.51412	1.08997
147	3	2	111	174	11.0000	13.0000	14.8125	3.8125	0.026883	0.28774	-0.3934	0.7869	-1.0595	-1.3541	.	0.542	-0.61223	0.74191
148	3	2	113	248	13.0000	14.0000	16.0000	3.0000	0.081615	0.40880	-0.6667	1.0000	-0.2959	-1.1161	.	0.917	-0.08662	1.02951
149	3	2	114	95	11.0000	12.4800	14.0000	3.0000	0.044670	0.32296	-0.5800	0.7533	-2.2721	-2.6252	.	0.575	-0.55372	2.07150
150	3	2	164	2980	11.0000	13.0000	15.0000	4.0000	0.096250	0.50341	-0.5000	3.6250	0.1843	-0.5748	.	0.863	-0.14767	0.42717
151	3	2	242	1326	12.0000	14.0000	16.0000	4.0000	0.071112	0.41081	-0.5000	1.6250	-1.4259	-1.9329	.	0.670	-0.39989	1.53298
152	3	3	90	377	39.0000	43.0000	48.0000	9.0000	0.047341	0.39573	-0.7222	1.0556	-1.7096	-2.2544	.	0.696	-0.36207	1.89231
153	3	3	92	8755	39.2500	43.5000	47.0000	7.7500	-0.009678	0.37780	-1.0000	1.5161	-0.0750	-0.8784	.	0.902	-0.10349	0.77487
154	3	3	97	10573	39.0000	44.0000	48.0000	9.0000	0.009338	0.40226	-0.9444	1.6667	-0.8617	-1.5676	.	0.818	-0.20099	1.36656
155	3	3	98	793	45.0000	50.0000	53.0000	8.0000	-0.096465	0.43597	-1.2500	0.8750	-0.5014	-1.4274	.	1.019	0.01915	1.44652
156	3	3	100	2296	37.0000	41.0000	45.7500	8.7500	0.030151	0.36095	-0.7429	1.3143	-0.9597	-1.5350	.	0.718	-0.33160	1.20336
157	3	3	104	558	37.0000	40.0000	43.0000	6.0000	0.020173	0.46660	-0.8333	1.7500	-6.3428	-7.0865	.	0.849	-0.16320	6.92327
158	3	3	111	174	37.0000	43.0000	48.7499	11.7499	0.018509	0.31700	-0.5213	0.7660	-5.1939	-5.5167	.	0.558	-0.58408	4.93257
159	3	3	113	248	39.0000	43.0000	46.1799	7.1799	0.040447	0.43400	-0.7319	1.5321	-5.8781	-6.5004	.	0.752	-0.28456	6.21582
160	3	3	114	95	39.0000	41.0000	44.0000	5.0000	0.012112	0.38422	-1.0000	0.9000	-6.6068	-7.2926	.	0.802	-0.22108	7.07153
161	3	3	164	2980	37.0000	42.0000	46.0000	9.0000	-0.015330	0.37170	-0.8889	1.3889	-0.5355	-1.1915	.	0.778	-0.25088	0.94057
162	3	3	242	1326	40.2500	43.0000	47.0000	6.7500	0.051269	0.42644	-0.9430	2.0741	-0.8711	-1.6134	.	0.848	-0.16458	1.44881
163	4	2	90	377	13.0000	15.0000	19.0000	6.0000	0.088114	0.36715	-0.4167	1.0833	-2.0987	-2.4372	.	0.566	-0.56843	1.86873
164	4	2	92	8755	11.0000	12.0000	13.0000	2.0000	0.265000	1.07239	-0.5000	8.5000	0.8443	-0.4832	.	1.523	0.42060	0.90379
165	4	2	97	10573	11.0000	12.0000	14.0000	3.0000	0.250000	0.67607	-0.3333	4.6667	0.5014	-0.4751	.	1.072	0.06970	0.54485
166	4	2	98	793	15.0000	15.5000	18.0000	3.0000	0.130000	0.46486	-0.7500	2.5833	0.4238	-0.6269	.	1.155	0.14385	0.77074
167	4	2	100	2296	15.0000	19.0000	21.7500	6.7500	-0.022091	0.35933	-0.5926	1.2593	-0.0866	-0.6918	.	0.740	-0.30161	0.39021
168	4	2	104	558	15.0000	20.0000	24.0000	9.0000	0.038804	0.37734	-0.5000	1.3333	-0.7724	-1.2062	.	0.623	-0.47307	0.73314
169	4	2	111	174	14.0000	15.0000	18.0000	4.0000	0.113748	0.40674	-0.5000	1.5000	-0.3056	-0.9627	.	0.779	-0.24976	0.71297
170	4	2	113	248	16.0000	19.0000	22.0000	6.0000	0.078022	0.48477	-0.6667	1.4167	-0.9834	-1.6811	.	0.811	-0.20925	1.47180
171	4	2	114	95	12.0000	14.0000	17.0000	5.0000	0.128838	0.45227	-0.4000	1.6000	-1.4567	-1.8520	.	0.600	-0.51155	1.34042
172	4	2	164	2980	12.0000	13.0000	15.0000	3.0000	0.236666	0.74993	-0.5000	4.1667	0.5905	-0.5389	.	1.249	0.22254	0.76144
173	4	2	242	1326	13.0000	15.0000	19.0000	6.0000	0.120547	0.39356	-0.4167	1.7500	-1.3534	-1.7234	.	0.585	-0.53691	1.18648

OBS	FILE_NO	CHANNEL	GR_TRUTH	SMPL_SIZ	Q_25	Q_50	Q_75	IQ_R	MEAN_IQ	STD_IQ	IQ_01	IQ_99	LOG_SPC	LOG_WSPC	LOG_FOQO	SIGMA_O	LOG_SIGO	LG_SOWS
174	4	3	90	377	47.0000	51.0000	57.0000	10.0000	0.11187	0.54211	-0.9720	1.8000	-1.0773	-1.9210	.	0.939	-0.06316	1.85783
175	4	3	92	8755	49.0000	54.0000	59.0000	10.0000	0.00794	0.40551	-1.2000	1.7500	0.0179	-0.8324	.	0.945	-0.05657	0.77584
176	4	3	97	10573	0.0000	0.0000	0.0000	0.0000	0.54000	5.40000	0.0000	54.0000	5.6519	-0.2058	.	141.298	4.95087	5.15666
177	4	3	98	793	61.0000	71.0000	77.7500	16.7500	-0.04775	0.33029	-0.8060	0.7463	-0.9628	-1.4863	.	0.682	-0.38332	1.10298
178	4	3	100	2296	43.0000	49.0000	56.0000	13.0000	0.03077	0.39067	-0.8077	1.5385	0.0063	-0.6597	.	0.786	-0.24087	0.41878
179	4	3	104	558	40.0000	47.0000	53.0000	13.0000	0.01238	0.39469	-0.6538	1.8077	-0.3133	-0.8201	.	0.670	-0.40002	0.42011
180	4	3	111	174	46.2500	55.0000	62.0000	15.7500	0.00690	0.32112	-0.6349	0.7302	-3.7986	-4.1619	.	0.581	-0.54366	3.61820
181	4	3	113	248	44.0000	49.0000	53.0000	9.0000	-0.00196	0.37798	-0.8333	1.0000	-1.3375	-1.9590	.	0.752	-0.28540	1.67357
182	4	3	114	95	47.0000	51.0000	55.0000	8.0000	-0.03403	0.50460	-2.1875	1.0625	-0.9529	-2.2132	.	1.424	0.35340	2.56656
183	4	3	164	2980	47.0000	53.0000	59.0000	12.0000	0.01909	0.42414	-1.0913	1.5833	-1.2025	-1.9647	.	0.865	-0.14471	1.81998
184	4	3	242	1326	49.2500	54.0000	59.0000	9.7500	0.05192	0.44531	-1.0769	1.5897	-0.5454	-1.3403	.	0.894	-0.11194	1.22837
185	5	2	90	377	14.0000	16.0000	24.0000	10.0000	0.16075	0.37199	-0.2500	1.3500	-1.4246	-1.6591	.	0.510	-0.67239	0.98671
186	5	2	92	8755	12.2500	14.0000	15.0000	2.7500	0.23235	0.89847	-0.5455	6.0000	-0.4299	-1.3389	.	1.002	0.00215	1.34102
187	5	2	97	10573	12.0000	12.5000	15.0000	3.0000	0.30333	0.84649	-0.4167	5.5833	0.5960	-0.4769	.	1.181	0.16602	0.64293
188	5	2	98	793	15.0000	16.0000	18.0000	3.0000	0.19833	0.65293	-0.8333	3.6667	0.5786	-0.5688	.	1.272	0.24050	0.80929
189	5	2	100	2296	20.0000	26.0000	32.0000	12.0000	0.02053	0.36533	-0.5833	1.1667	-0.0841	-0.6151	.	0.687	-0.37587	0.23926
190	5	2	104	558	20.8124	29.5000	37.0000	16.1876	-0.00049	0.32287	-0.5405	0.7568	-1.3346	-1.6888	.	0.575	-0.55274	1.13603
191	5	2	111	174	15.2500	18.7500	21.8125	6.5625	0.03371	0.35199	-0.4571	1.6953	-5.8105	-6.0374	.	0.507	-0.67999	5.35745
192	5	2	113	248	18.0000	21.0000	23.7500	5.7500	-0.00767	0.33992	-0.7826	0.9565	-1.2237	-1.7680	.	0.696	-0.36247	1.40558
193	5	2	114	95	14.0000	17.0000	20.0000	6.0000	0.06910	0.47639	-0.5833	1.8333	-1.3445	-1.8854	.	0.694	-0.36594	1.51947
194	5	2	164	2980	13.0000	15.0000	19.0000	6.0000	0.16106	0.53115	-0.3333	3.0000	-0.1000	-0.7010	.	0.736	-0.30590	0.39508
195	5	2	242	1326	14.0000	18.0000	22.0000	8.0000	0.06258	0.39451	-0.4375	1.6250	-1.9339	-2.3006	.	0.583	-0.54022	1.76037
196	5	3	90	377	49.0000	55.3899	62.0000	13.0000	0.03732	0.33783	-0.4804	1.1388	-4.9206	-5.2071	.	0.538	-0.62028	4.58686
197	5	3	92	8755	50.0000	54.0000	58.0000	8.0000	0.06437	0.47052	-1.1250	2.1875	0.1278	-0.7405	.	0.962	-0.03859	0.70192
198	5	3	97	10573	60.2500	68.0000	74.7500	14.5000	-0.01621	0.33677	-0.7586	1.0000	-0.1971	-0.7710	.	0.717	-0.33296	0.43803
199	5	3	98	793	65.0000	74.0000	77.8748	12.8748	-0.10873	0.35418	-1.0486	0.5825	-0.6155	-1.3129	.	0.811	-0.20954	1.10331
200	5	3	100	2296	49.0000	53.0000	58.0000	9.0000	0.05001	0.46307	-1.0000	1.9444	0.1266	-0.7220	.	0.943	-0.05830	0.66370
201	5	3	104	558	47.8124	53.0000	57.7500	9.9376	0.01209	0.42672	-0.8050	1.4591	-4.8370	-5.4721	.	0.762	-0.27180	5.20027
202	5	3	111	174	45.1250	54.0000	61.7499	16.6249	-0.00587	0.28341	-0.5113	0.6015	-4.4886	-4.7421	.	0.520	-0.65337	4.08873
203	5	3	113	248	47.0000	50.0000	55.0000	8.0000	0.09465	0.47385	-1.5331	1.5000	-1.3288	-2.3599	.	1.132	0.12421	2.48407
204	5	3	114	95	44.0000	49.0000	54.0000	10.0000	0.01776	0.45430	-1.1000	1.3000	-3.4513	-4.2417	.	0.890	-0.11649	4.12522
205	5	3	164	2980	50.0000	55.0000	62.0000	12.0000	0.05976	0.39738	-0.9167	1.4167	-0.5358	-1.2137	.	0.795	-0.22891	0.98481
206	5	3	242	1326	50.0000	54.5000	61.7500	11.7500	0.08167	0.40925	-0.7447	1.4681	-0.7698	-1.3693	.	0.735	-0.30730	1.06203

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