Statistical Test for Distance in Device A

FPS Processed in Relation to Distance in Device A for 30 Second Period(FPS)

Quality(%)	10	20	30	40	50	60	70	80	90	98
Average FPS Sent	13.67	13.60	12.70	10.73	8.87	7.77	5.90	3.43	2.03	1.00
Total FPS Sent	410	408	381	322	266	233	177	103	61	30

The calculated sample mean:

$\bar{x} = \frac{x_1 + \cdots + x_n}{n}$

$\bar{x}_1 = 13.67,\ \bar{x}_2 = 13.60,\ \bar{x}_3 = 12.70,\ \bar{x}_4 = 10.73,\ \bar{x}_5 = 8.87,$
$\bar{x}_6 = 7.77,\ \bar{x}_7 = 5.90,\ \bar{x}_8 = 3.43,\ \bar{x}_9 = 2.03,\ \bar{x}_{10} = 1.00$

	$\bar{x}_1$	$\bar{x}_2$	$\bar{x}_3$	$\bar{x}_4$	$\bar{x}_5$	$\bar{x}_6$	$\bar{x}_7$	$\bar{x}_8$	$\bar{x}_9$	$\bar{x}_{10}$
Squared Differences	18.67	43.20	38.30	73.87	63.47	41.37	72.70	43.37	22.97	0.00
Variance (s^2)	0.64	1.49	1.32	2.55	2.19	1.43	2.51	1.50	0.79	0.00
Standard Deviation(s)	0.80	1.22	1.15	1.60	1.48	1.19	1.58	1.22	0.89	0.00

The calculated sample variance:

$s_i^2 = (x_i - \bar{x})$

$s_1^2 = 0.64,\ s_2^2 = 1.49,\ s_3^2 = 1.32,\ s_4^2 = 2.55,\ s_5^2 = 2.19,$
$s_6^2 = 1.43,\ s_7^2 = 2.51,\ s_8^2 = 1.50,\ s_9^2 = 0.79,\ s_{10}^2 = 0.00$

The calculated sample standard deviation:

$s_1 = 0.80,\ s_2 = 1.22,\ s_3 = 1.15,\ s_4 = 1.60,\ s_5 = 1.48$
$s_6 = 1.19,\ s_7 = 1.58,\ s_8 = 1.22,\ s_9 = 0.89,\ s_{10} = 0.00$

Confidence Level	s_1	s_2	s_3	s_4	s_5	s_6	s_7	s_8	s_9	s_{10}
90%	0.25	0.38	0.36	0.49	0.46	0.37	0.49	0.38	0.28	0.00
95%	0.30	0.46	0.43	0.60	0.55	0.45	0.59	0.46	0.33	0.00
99%	0.40	0.61	0.58	0.80	0.74	0.60	0.79	0.61	0.45	0.00

Normally distributed random variable (As the sample size is less 100, 30 which is apply normal distributions)

Let's choose the confidence level of 95%, then $\alpha = 0.05$.

We calculate the margin of error.

$E = t_{\frac{\alpha}{2}} \frac{s}{\sqrt{n}} = 2.042 * \frac{s_i}{\sqrt{30}}$

$E_1 = 0.30,\ E_2 = 0.46,\ E_3 = 0.43,\ E_4 = 0.60,\ E_5 = 0.55,$
$E_6 = 0.45,\ E_7 = 0.59,\ E_8 = 0.46,\ E_9 = 0.33,\ E_{10} = 0.00$

	E_1	E_2	E_3	E_4	E_5	E_6	E_7	E_8	E_9	E_{10}
$\bar{x}_i + E_i$	13.97	14.06	13.13	11.33	9.42	8.21	6.49	3.89	2.37	1.00
$\bar{x}_i - E_i$	13.37	13.14	12.27	10.14	8.32	7.32	5.31	2.98	1.70	1.00

The confidence interval is:

$$\bar{x} \pm E = \bar{x}_i \pm E_i$$

C.I. for all quality are:

$(13.37,\ 13.97), (13.14,\ 14.06), (12.27,\ 13.13), (10.14,\ 11.33), (8.32,\ 9.42),$
$(7.32,\ 8.21), (5.31,\ 6.49), (2.98,\ 3.89), (1.70,\ 2.37), (1.00,\ 1.00)$

This is accuracy of the estimates with respect to the sample size 30 because most results of sample standard deviation are true positive. Therefore, we could retreat the sample mean to predict the true mean of the population of all distance in Device A.

Statistical Test for Quality in Device A

FPS Processed in Relation to Quality Ratio in Device A for 30 Second Period(FPS)

Quality(%)	10	20	30	40	50	60	70	80	90	98
Average FPS Sent	12.93	11.43	10.87	10.83	9.83	9.53	8.97	8.03	7.1	4.03
Total FPS Sent	388	343	326	325	295	286	269	241	213	121

The calculated sample mean:

$$\bar{x} = \frac{x_1 + \cdots + x_n}{n}$$

$\bar{x}_1 = 12.93,\ \bar{x}_2 = 11.43,\ \bar{x}_3 = 10.87,\ \bar{x}_4 = 10.83,\ \bar{x}_5 = 9.83,$
$\bar{x}_6 = 9.53,\ \bar{x}_7 = 8.97,\ \bar{x}_8 = 8.03,\ \bar{x}_9 = 7.1,\ \bar{x}_{10} = 4.03$

	$\bar{x}_1$	$\bar{x}_2$	$\bar{x}_3$	$\bar{x}_4$	$\bar{x}_5$	$\bar{x}_6$	$\bar{x}_7$	$\bar{x}_8$	$\bar{x}_9$	$\bar{x}_{10}$
Squared Differences	31.87	21.37	25.47	24.17	48.17	39.47	30.97	26.97	26.70	10.97
Variance (s^2)	1.10	0.74	0.88	0.83	1.66	1.36	1.07	0.93	0.92	0.38
Standard Deviation(s)	1.05	0.86	0.94	0.91	1.29	1.17	1.03	0.96	0.96	0.61

The calculated sample variance:

$$s_i^2 = (x_i - \bar{x})$$

$s_1^2 = 1.10,\ s_2^2 = 0.74,\ s_3^2 = 0.88,\ s_4^2 = 0.83,\ s_5^2 = 1.66,$
$s_6^2 = 1.36,\ s_7^2 = 1.07,\ s_8^2 = 0.93,\ s_9^2 = 0.92,\ s_{10}^2 = 0.38$

The calculated sample standard deviation:

$s_1 = 1.05,\ s_2 = 0.86,\ s_3 = 0.94,\ s_4 = 0.91,\ s_5 = 1.29$
$s_6 = 1.17,\ s_7 = 1.03,\ s_8 = 0.96,\ s_9 = 0.96,\ s_{10} = 0.61$

Confidence Level	s_1	s_2	s_3	s_4	s_5	s_6	s_7	s_8	s_9	s_{10}
90%	0.32	0.27	0.29	0.28	0.40	0.36	0.32	0.30	0.30	0.19
95%	0.39	0.32	0.35	0.34	0.48	0.43	0.39	0.36	0.36	0.23
99%	0.53	0.43	0.47	0.46	0.65	0.59	0.52	0.48	0.48	0.31

Normally distributed random variable (As the sample size is less 100, 30 which is apply normal distributions)

Let's choose the confidence level of 95%, then $\alpha = 0.05$.

We calculate the margin of error.

$$E = t_{\frac{\alpha}{2}} \frac{s}{\sqrt{n}} = 2.042 * \frac{s_i}{\sqrt{30}}$$

$$E_1 = 0.32,\ E_2 = 0.27,\ E_3 = 0.29,\ E_4 = 0.28,\ E_5 = 0.40,$$
$$E_6 = 0.36,\ E_7 = 0.32,\ E_8 = 0.30,\ E_9 = 0.30,\ E_{10} = 0.19$$

	E_1	E_2	E_3	E_4	E_5	E_6	E_7	E_8	E_9	E_{10}
$\bar{x}_i + E_i$	13.32	11.75	11.22	11.17	10.31	9.97	9.35	8.39	7.46	4.26
$\bar{x}_i - E_i$	12.54	11.11	10.52	10.49	9.35	9.10	8.58	7.67	6.74	3.80

The confidence interval is:

$$\bar{x} \pm E = \bar{x}_i \pm E_i$$

C.I. for all quality are:

$$(12.54,\ 13.32), (11.11,\ 11.75), (10.52,\ 11.22), (10.49,\ 11.17), (9.35,\ 10.31),$$
$$(9.10,\ 9.97), (8.58,\ 9.35), (7.67,\ 8.39), (6.74,\ 7.46), (3.80,\ 4.26)$$

This is accuracy of the estimates with respect to the sample size 30 because most results of sample standard deviation are true positive. Therefore, we could retreat the sample mean to predict the true mean of the population of all quality in Device A.