

Video Game Performance Data: Summarizing with Statistics and Graphs

Based on *Serious Statistics Reprocessed: Statistics and Scripts*

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November 5, 2019



Presentation and Article

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Problem: Summarizing Data in Representative Way

Line	Application	ProcessID	SwapChainAddress	Device	ScreenWidth	PresentFlags	ReleaseTesting	PresentMode	HardwareComposited	HardwareComposited	DeviceResized	DeviceResized	DeviceResized	TimeInSeconds	MsBetweenPresents	MsBetweenDisplayChange	MsInPresentAPI	MsUntilRenderComplete	MsUntilDisplayed	MsEstimatedDriverLag	Width	Height
1	Sam2017.exe	1812	C:\Users\jpitch\Documents\Sam2017.exe	0004	0	0	0	Hardware Composited	Indeterminate F.p.p.	1	0	0	0	0.000013	3.364	1.729	0.000	0.000	0.000	0.000	1920	1080
2	Sam2017.exe	1812	C:\Users\jpitch\Documents\Sam2017.exe	0004	0	0	0	Hardware Composited	Indeterminate F.p.p.	1	0	0	0	0.000013	3.364	1.729	0.000	0.000	0.000	0.000	1920	1080
3	Sam2017.exe	1812	C:\Users\jpitch\Documents\Sam2017.exe	0004	0	0	0	Hardware Composited	Indeterminate F.p.p.	1	0	0	0	0.000013	3.364	1.729	0.000	0.000	0.000	0.000	1920	1080
...																						
81356	Sam2017.exe	1812	C:\Users\jpitch\Documents\Sam2017.exe	0004	0	0	0	Hardware Composited	Indeterminate F.p.p.	1	0	0	100.000738	3.687	4.023	0.000	0.000	0.000	0.000	1920	1080	
81357	Sam2017.exe	1812	C:\Users\jpitch\Documents\Sam2017.exe	0004	0	0	0	Hardware Composited	Indeterminate F.p.p.	1	0	0	100.000738	3.687	4.026	0.000	0.000	0.000	0.000	1920	1080	

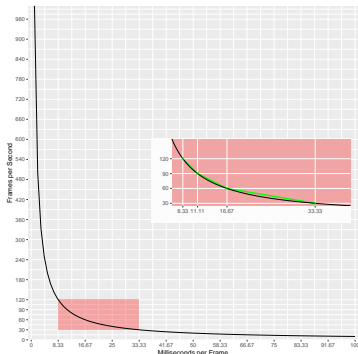
- Video game performance measurements can result in rather large recordings

Line	Application	...	TimeInSeconds	MsBetweenPresents	MsBetweenDisplayChange	MsInPresentAPI	MsUntilRenderComplete	MsUntilDisplayed	MsEstimatedDriverLag	Width	Height
1	Sam2017.exe		0.005609	4.257	3.884	0.166	3.284	3.284	7.446	1920	1080
2	Sam2017.exe		0.009513	3.904	3.729	0.080	3.109	3.109	6.847	1920	1080
3	Sam2017.exe		0.012988	3.475	3.628	0.072	3.262	3.262	6.658	1920	1080
...											
81356	Sam2017.exe		300.306738	3.682	3.687	0.362	4.023	4.023	7.343	1920	1080
81357	Sam2017.exe		300.310425	3.687	3.690	0.363	4.026	4.026	7.351	1920	1080

- Even after ignoring developer-oriented data, there can still be a lot
- Clear statistics and graphs to provide representative summaries of data are necessary

Problem: FPS vs milliseconds

How you measure the data and the units the statistics are in also matter



- FPS is a **non-linear** measurement but **clear**
- milliseconds is **linear** but not as **clear**

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Problem: Which Statistics

Average is an ambiguous term, but can assume

Arithmetic Mean:

$$\sum \frac{x_n}{n}$$

Average is the expected value or central tendency of a distribution like the

Median:

$$x_1 \dots x_{n/2} \dots x_n \quad \text{or} \quad x_1 \dots \frac{x_{n/2-1} + x_{n/2+1}}{2} \dots x_n$$

Geometric Mean:

$$\prod \sqrt[n]{x_n} \quad \text{or} \quad e^{\overline{\log(x)}}$$

Advantages and disadvantages make it context sensitive

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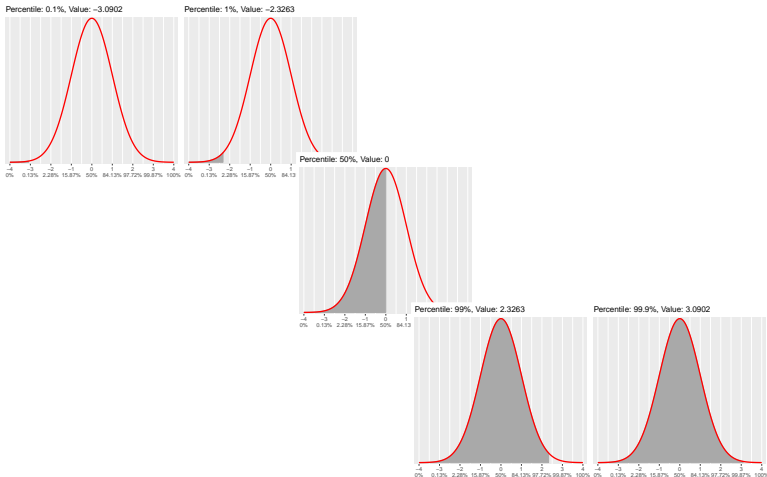
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Problem: Which Statistics

Central tendencies may or may not be sensitive to outliers
Performance bounds are also useful information
Percentiles (Quantiles):



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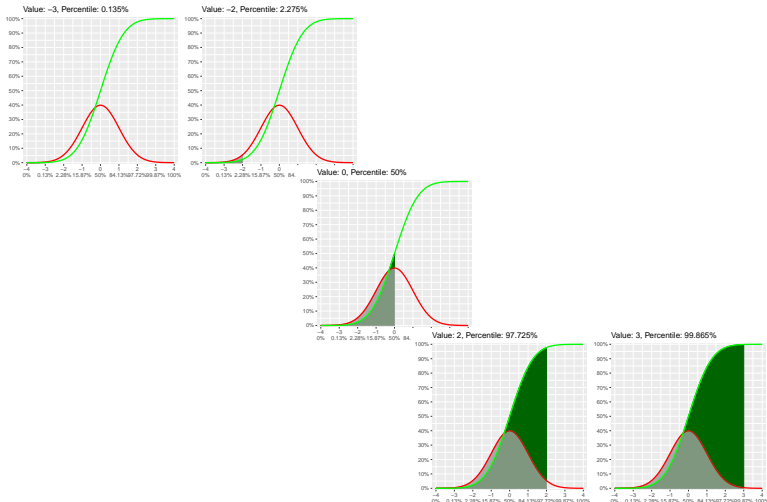
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Problem: Which Statistics

Reverse: Finding the bound for a value

Empirical Cummulative Distribution Function (ECDF):



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Results:

Serious Sam Fusion 2017 - DirectX 11

GPU	Location		Mean	Median	0.1%	1%	99%	99.9%	60 FPS
RX Vega 64	Hatsheput	FPS	270.91	267.52	393.65	365.5	226.55	209.9	0
RTX 2060	Hatsheput	FPS	226.67	226.09	303.57	288.18	180.34	172.21	0
RX Vega 64	Hatsheput	ms	3.69	3.74	2.54	2.74	4.41	4.76	0
RTX 2060	Hatsheput	ms	4.41	4.42	3.29	3.47	5.54	5.81	0

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- | | |
|----------------------------|--------------|
| ●Techspot/Hardware Unboxed | ●Level1Techs |
| ●Gamers Nexus | ●Phoronix |

Means, Medians, and Percentiles

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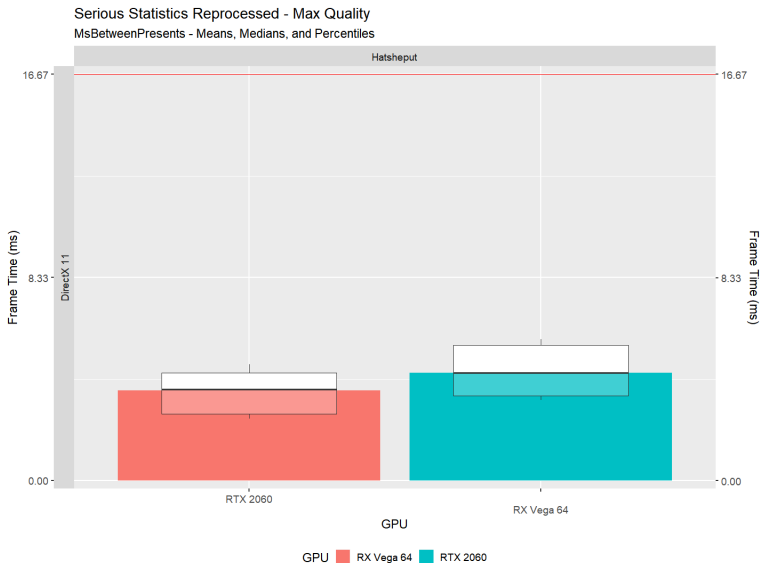
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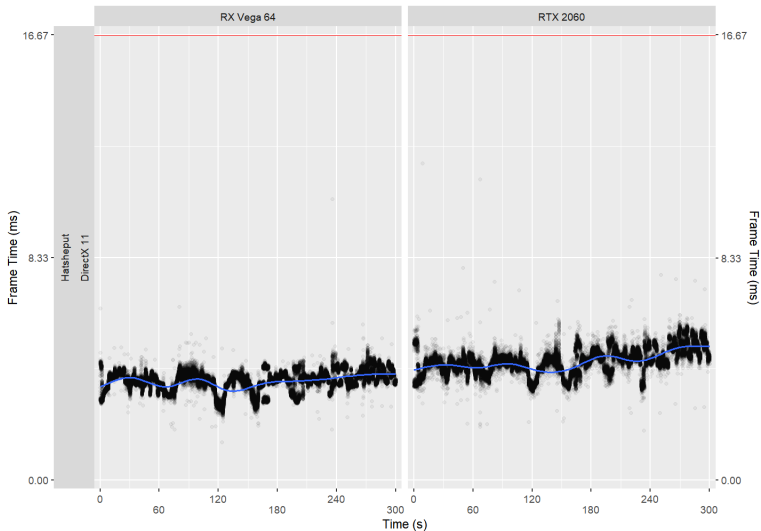


Course, Density, Smooth

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Serious Statistics Reprocessed - Max Quality
MsBetweenPresents - Course



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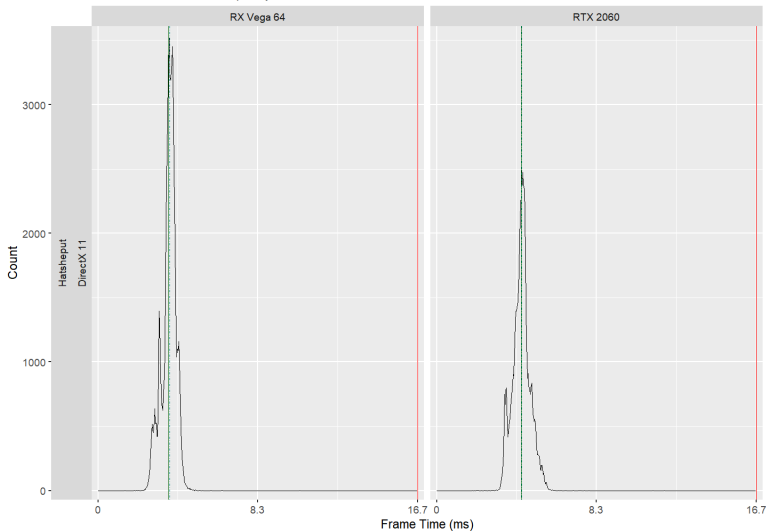
References

Frequency, Thin Bins, and Statistics

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Serious Statistics Reprocessed - Max Quality
MsBetweenPresents - Frequency Plot



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Quantiles, Guides, and Line

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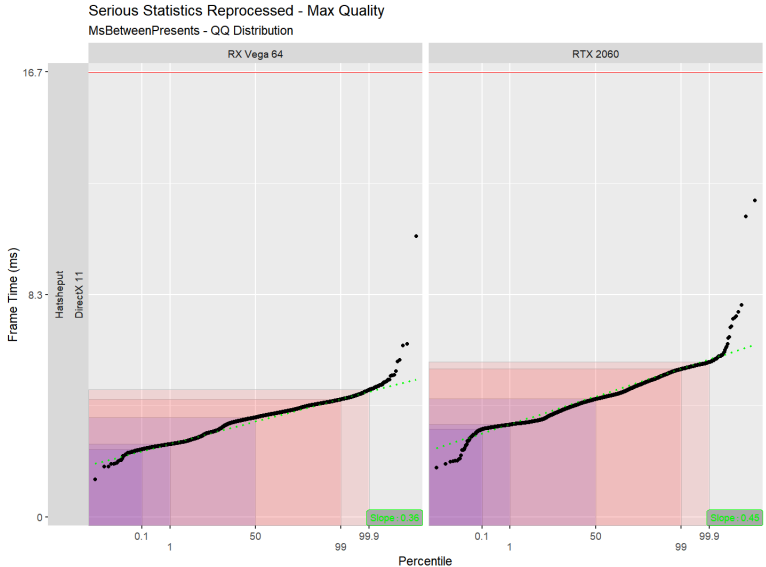
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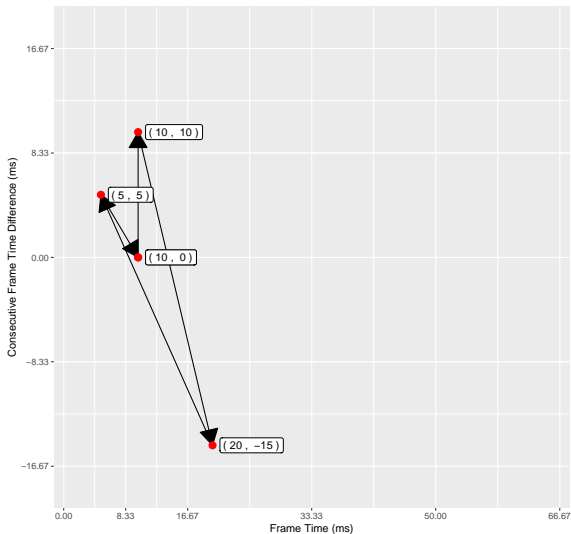
Consecutive Difference - Example

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10, ... 10, 20, 5, 10, ... 10

Example
Consecutive Differences



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Consecutive Difference, Density, and Heatmap

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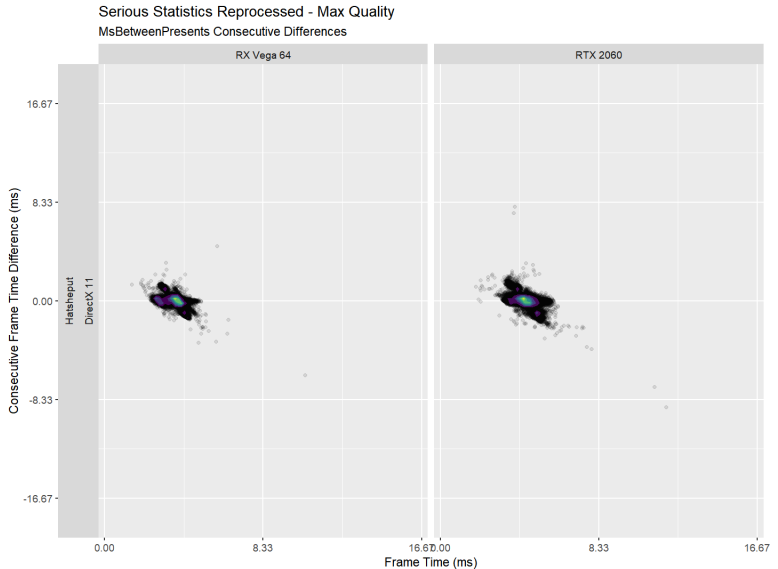
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References:

Example Graphs can be found at:

- Techspot/Hardware Unboxed - [NVIDIA GeForce GTX 1660 Super Review](#)
- Level1Techs - [Radeon 5700 & 5700XT Launch Coverage & Testing](#)
- Gamers Nexus - [PowerColor RX 5700 Red Dragon Review: First of the Partners](#)
- Phoronix - [NVIDIA RTX 2060 / 2070 / 2080 SUPER Linux Gaming Performance](#)

Original **Serious Statistics Reprocessed: Statistics and Scripts** can be found on GitHub

All data, statistics, graphs, and scripts are in the repository



github.com/GuestJim/Serious-Statistics-Reprocessed