Statistical Analysis of Professional Photographer's Estimated Return on Investment (ROI) Turnaround Time

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Abstract

Professional photography relies heavily on engaging audiences and delivering to a diverse range of clients on a schedule. The business requires an initial investment of time to be on-site, shoot photographs, and conduct image processing before delivering the final product. The time required in this workflow is difficult for humans to gauge, meaning an unknown duration before a return on investment (ROI) between the time that money is spent to take the photograph and the time the photographs can be licensed or sold. Statistical techniques can be used to extract, analyze, and visualize how a professional[1] photographer can estimate how many days, on average, pass between when a photograph is taken and when the photograph gets uploaded. Since each client requires a specific image category[2], such as "Landscapes" or "Journalism", a more accurate estimate can be calculated on a categorical basis.

Introduction

500px.com is a large social networking site for photography professionals to share and sell images. Unlike most social networking sites, a large majority of images are posted to 500px after an extensive process of transferring large image files from a DSLR to a computer and performing time intensive image touchups. Additionally, professional photography requires a great deal of travel therefore the time between taking a photo and uploading it is significantly longer than other websites. 500px.com/popular is a section that lists the top photographs from the website's population of professional photographers.

[1] A "professional photographer" in this study is defined as an individual who has a sufficiently popular following of fans, whose photographs make it to the "popular" section of 500px.com

[2] An "image category" is defined as the primary subject of the photograph

Data Collection

There is no existing public database that sufficiently represents the target population. 500px.com is an outlet for the photographer community and the "popular" section best represents the population that is classified as "professional" workers, subset of the entire professional photographer population. While the entire population of professional photographers cannot be sampled, the data collected from this source is a sufficient sample. The site has a public developer application interface program (API) hosted at developers.500px.com which can be accessed using an API token[3]. A python script[4] was written to collect all the image metadata and add it to a database so it can be analyzed using R.

Table 1: Excerpt from sample data set[5]

URL	Category	Days To Upload
500px.com/photo/234815327	Landscapes	358
500px.com/photo/234793089	Travel	1070
500px.com/photo/234774847	Landscapes	262
500px.com/photo/234850045	Landscapes	53
500px.com/photo/234840743	Landscapes	33
...	...	...

The "URL" is a direct link to the photograph and the "Category" is parsed from that image's metadata. There are thirty categories on the site, of which the following are collected: Sport, Journalism, Landscapes, and Travel. The "Days To Upload" column is calculated by subtracting the uploaded date from the date that the photograph was taken, both of which are found in the metadata. All images where

[3] Instructions on how to obtain an API token is available at https://github.com/500px/api-documentation

[4] The python script which collected the data set is available for download at https://github.com/Collinux/photo-roi-turnaround/blob/master/collect.py

[5] Table 1: Raw data collection available for download at https://github.com/Collinux/photo-roi-turnaround/blob/master/photos.dat

the “Days To Upload” are greater than or equal to 365 (days) are omitted from the study. If the difference between the date taken and the date uploaded is over a year then it does not fit into the return on investment for the same fiscal or taxable year.

Analysis

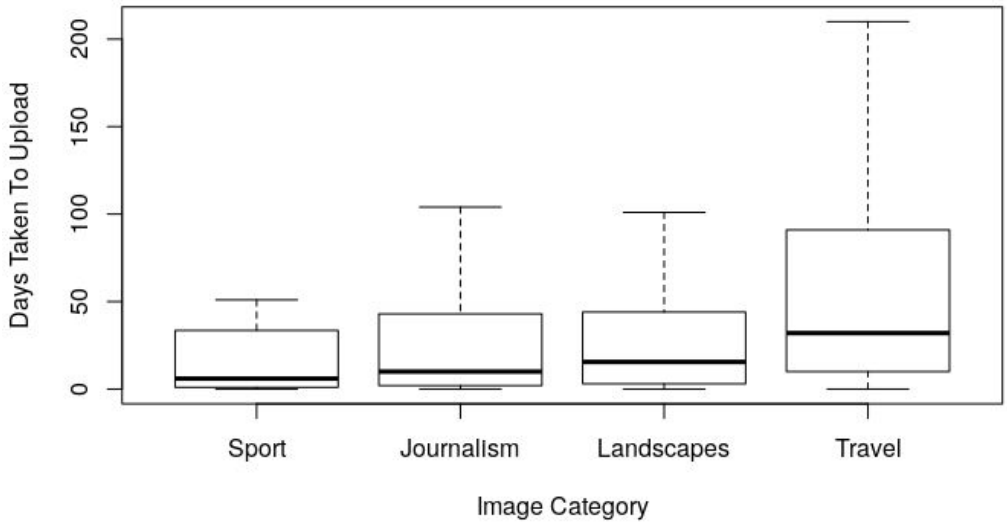
The data collected by the python script was imported into R and analyzed to determine the effect of the image category on the days taken to upload. Confidence intervals are calculated using a t-test for each image category in order to determine on average how long a particular image category will take for professional photographers to upload. Pairwise comparisons using a t-test for each image category are calculated to determine a p-value to test for equality as a null hypothesis versus non-equality as an alternative hypothesis.

Table 2: Summary of the collected dataset[6]

Category	Journalism	Landscapes	Sport	Travel	**TOTAL**
Images Collected	51	6216	119	765	**7151**
Variance	157.8541	555.0686	727.0587	3147.176	-
Mean	9.470588	17.32497	22.2605	51.72418	-

[6] Table 2: Summary of dataset available for download at https://github.com/Collinux/photo-roi-turnaround/blob/master/status.txt

Figure 3: Metadata from 500px.com/popular (outliers removed)

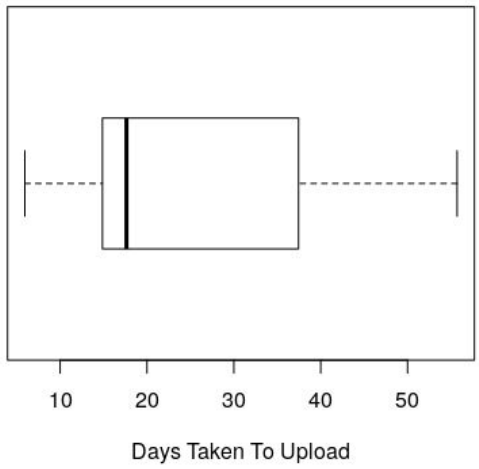


The mean for Journalism was the smallest at nearly 9.5, the next largest was Landscapes at approximately 17, followed by Sport at approximately 22, then Travel at nearly 52. Due to the positive skewness of each sample implying a non-normally distributed sample a Wilcoxon rank-sum test was also conducted on each below hypothesis in addition to a t-test. The p-values of the Wilcoxon rank-sum test do not deviate from the conclusions of the t-test therefore all below intervals and p-values were calculated t-tests.

Professional photographers take on average between 20 and 22 days to post their images.

Across all the sampled image categories professional photographers take on average between approximately 20 and 22 days to start earning a return on investment for a photograph, with 95% simultaneous confidence (using bonferroni adjustment).

Figure 4: Elapsed Days Across All Categories



For the individual image category of "Journalism", professional photographers take on average between approximately 6 and 13 days to start earning a return on investment for the photograph, with 95% confidence.

H_0: μ Journalism = μ Landscapes H_a: μ Journalism ≠ μ Landscapes
Since the p-value is nearly 0 there is strong evidence that journalism and landscape images do not take an equal amount of time for professional photographers to upload.

H_0: μ Journalism = μ Sports H_a: μ Journalism ≠ μ Sports
Since the p-value is nearly 0 there is strong evidence that journalism and sport images do not take an equal amount of time for professional photographers to upload.

H_0: μ Journalism = μ Travel H_a: μ Journalism ≠ μ Travel
Since the p-value is nearly 0 there is strong evidence that journalism and sport images do not take an equal amount of time for professional photographers to upload.

For the individual image category of “Landscapes”, professional photographers take on average between approximately 17 and 18 days to start earning a return on investment for the photograph, with 95% confidence.

H_0: μ Landscapes = μ Sports H_a: μ Journalism ≠ μ Sports
Since the p-value is 0.0497 there is suggestive but inconclusive evidence that landscape and sports images do not take an equal amount of time for professional photographers to upload.

H_0: μ Landscapes = μ Travel H_a: μ Journalism ≠ μ Travel
Since the p-value is nearly 0 there is strong evidence that landscape and travel images do not take an equal amount of time for professional photographers to upload.

For the individual image category of “Sport”, professional photographers take on average between approximately 17 and 27 days to start earning a return on investment for the photograph, with 95% confidence.

H_0: μ Sport = μ Travel H_a: μ Sport ≠ μ Travel
Since the p-value is nearly 0 there is strong evidence that sport and travel images do not take an equal amount of time for professional photographers to upload.

For the individual image category of “Travel”, professional photographers take on average between approximately 48 and 56 days to start earning a return on investment for the photograph, with 95% confidence.