Popularity of Munroes

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1 Overview

Munros are an iconic part of Scottish landscape and culture, with many people considering Munro climbing a hobby. Our objective was to see if there is a statistical relationship between the height of Munros and their popularity. We used web scraping and obtained data fro. websites on heights of Munros and the frequency of ascents. Then we plotted this in a scattergraph and used statistical methods such as linear regression, correlation coefficients and hypothesis testing to explore this. We concluded that their was no significant statistical relationship between height of Munros and the popularity.

2 Introduction

Context and motivation Munros are mountains found in Scotland classified as being over 3000ft high with summits of "sufficient distance" from surrounding summits. This classification was first conceived in the late 19th century by Sir Hugh Munro [1], when he wrote a journal article including a list of definitive mountains over 3000ft, with 282 of these later becoming known as "Munros".

By the 1980s "Munro bagging" had become a popular hobby where people challenged themselves to climb all the Munros in Scotland (when you reach the summit of one, you have "bagged" a Munro) [2]. Not much has changed in the present day, and Munros are still ascended by countless tourists and locals. Munros remain a big part of Scottish identity and culture. 34 percent of Munroists are from outside of Scotland and the Highlands is a top holiday destination for German and Dutch tourists [3], boosting Scotland's tourism industry and in turn, the economy.

We would like to use the data we have collected to examine the relationship between Munro heights and frequency of ascents in Scotland. Our study is looking into why a Munro is popular, and more specifically if height affects the popularity of a Munro.

Previous work Recent studies show that climbing Munros has increased in popularity in recent years due to a variety of reasons; including austerity leading to people valuing the cheap nature of hillwalking for holidays, shifting attitudes to women's leisure (30-40 percent of Munroists are now women), social media, and an increase in Scottish pride [4]. Furthermore, results from another study identifies the reasons why people climb mountains: "challenge, catharsis, recognition, creative opportunities, locus of control, and for the physical setting" [3]. The fact that mountaineers seek out challenge could be related to height, as the taller a mountain is, the more challenging it could be generally.

There has been research on why more and more people are climbing Munros, and the reasons why people climb mountains. However, there is no current research on what attributes of a Munro makes it popular, which is the idea behind this study.

Objectives What questions are you setting out to answer?

We are looking to answer if there is a relationship between the height of Munros and the popularity, or the frequency in which it is climbed.

3 Data

Data provenance The two datasets I used were from two websites: `/www.walkhighlands.co.uk/munros/most-climbed` `/https://www.smc.org.uk/hills/`

For the data on Munro ascents I utilised web scraping to obtain the data. We followed suggested guidelines on ethical web scraping, as we provided a User Agent string when requesting access to the site, stating our intentions and leaving a contact email if the owner of the data had any concerns. Also as the desired data was on one page, we only requested the data once, as to not overwhelm the site, and we scraped only what we needed from the site. The creators of the dataset are the owners of the Walkhighlands website, Helen and Paul Webster. The data on ascents uses the number of Walkhighlands' users who have climbed and logged them into the website, and on the T&Cs anything posted by users is agreed to have a "world-wide, royalty-free, non-exclusive licence" [5] to the owners of the website. The website is copyrighted and subject to fair use, so we can use the data in a non-commercial use, which this study is.

The data on Munro heights was from the website for the Scottish Mountaineering club. We obtained this data from copying and pasting the data we needed into a CSV file, as this was simpler than web scraping. We could not find anything in the T&Cs, so we assume that this study comes under fair use, as the data is used in a "transformative" , educational and non-commercial way.

Data description The data on Munro ascents was scraped into a table with three columns: the number, the name of the mountain, and number of ascents logged by users. There was 282 records for each Munro in Scotland. The data on Munro heights was modified into my own CSV file with two columns: the name of the mountain and the height to the summit. There was also 282 records in this table.

Data processing We cleaned the Munro ascents data by removing the number column as it wasn't necessary. As both datasets we wanted to use had 282 records with a common matching variable we decided to combine the two datasets into one dataset using the mountain names as the joining index. Before that could be done though, we used Microsoft Excel's Conditional Formatting to compare the mountain names for duplicate values in both columns. We made sure the unique values (e.g. the Mountain names that were different in each dataset due to spelling differences of the Gaelic names) were changed so the columns were both identical.

4 Exploration and analysis

Table 1: Excerpt from table showing Munros in Scotland, and the number of ascents made by Walkinghighlands users along with their heights (m). `https://simd.scot`. You may put more information in the caption.

Mountain	Number of Ascents	Height (m)
Ben Lomond	20683	974
Ben Nevis	18001	1345
Ben Lawers	16186	1214
Schiehallion	16051	1083
Beinn Ghlas	15770	1103
...	...	...

Table 1 1) shows an excerpt of the resulting table after the two cleaned tables are joined. As the variables we are looking at (Number of Ascents and Height) are numeric variables and we are trying to see a pattern, we created a scatter graph to identify if there is a trend.

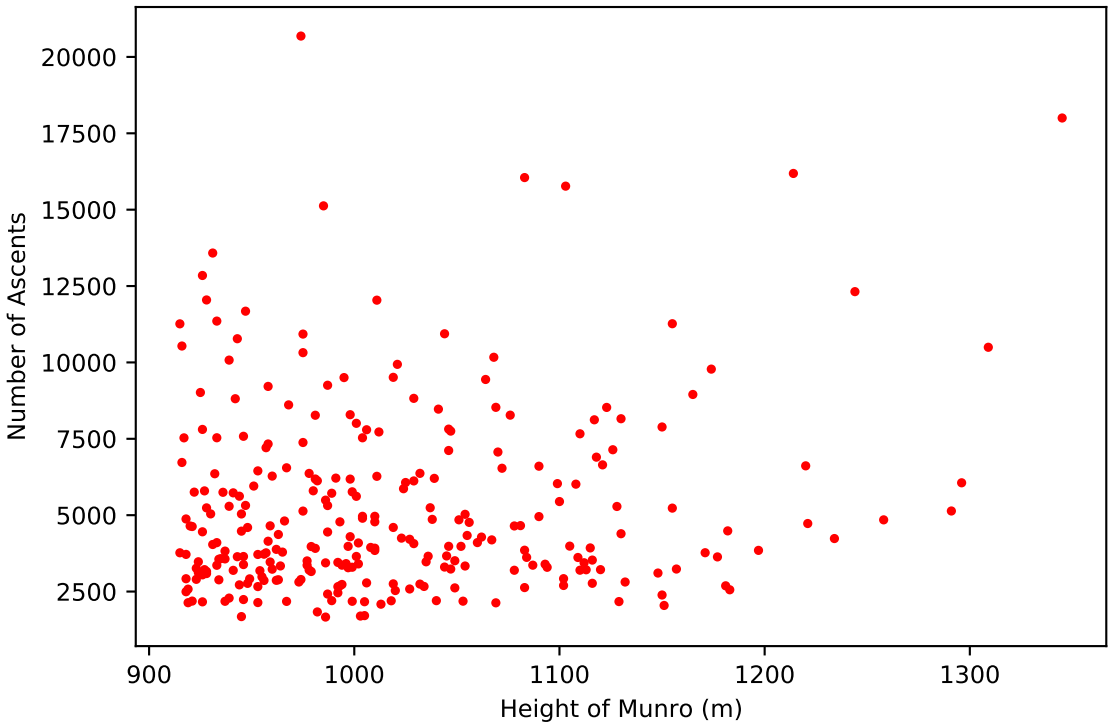

Figure 1: Scattergraph showing the relationship between height of Munro, and the frequency of ascents, with all the data

From Figure 1 we can see obvious outliers. We calculated Z-scores using a 95 percent confidence level for all the values in the independent variable (the number of ascents) and removed outliers rows from the dataset (where Z-scores were significant i.e. not between -1.96 and 1.96). We also utilised a regression line to represent the relationship between the independent variable (Height) and the dependent variable (Number of Ascents). These changes are shown in Figure 2. From looking at the regression line with the human eye it shows a positive correlation between height of Munro and the popularity amongst Walkinghighlands users, but the relationship is not very strong.

To test if there is indeed a statistical relationship between the two variables we used Pearson's r correlation coefficients for the x and y axis. The degree of correlation was calculated as 0.09045347 for the Munros (excluding outliers), r(264) =.09. This shows a very low degree of positive correlation, as a degree of 0 means no correlation and of 1 means perfect correlation. The test concludes that the correlation coefficient is not significantly different from zero, and the linear relationship we found between height and popularity of Munro on the regression line is not signifcant as there is not a strong enough correlation between the dependent and independent variables.

We further performed a hypothesis test to determine whether the correlation coefficient is significant. Null Hypothesis: Ho: p larger than a The correlation coefficient is not significantly different from 0. Alternate Hypothesis: Ha: p smaller than or equal a The correlation coefficient is significantly different from 0. a=p=0.05 We used the significance level of 0.05. This shows that the risk of concluding that a correlation exists, and being wrong is 5% We found the p-value to be 0.1427683, p=.14 which is greater than a, so we can conclude that the correlation is not statistically significant, so we cannot conclude that the correlation is different from 0. Therefore we cannot accept the alternative hypothesis.

Overall, all our tests show that the correlation we can see in the scatter graph is not significant. There is not steep enough gradient in the regression line for the findings to be used.

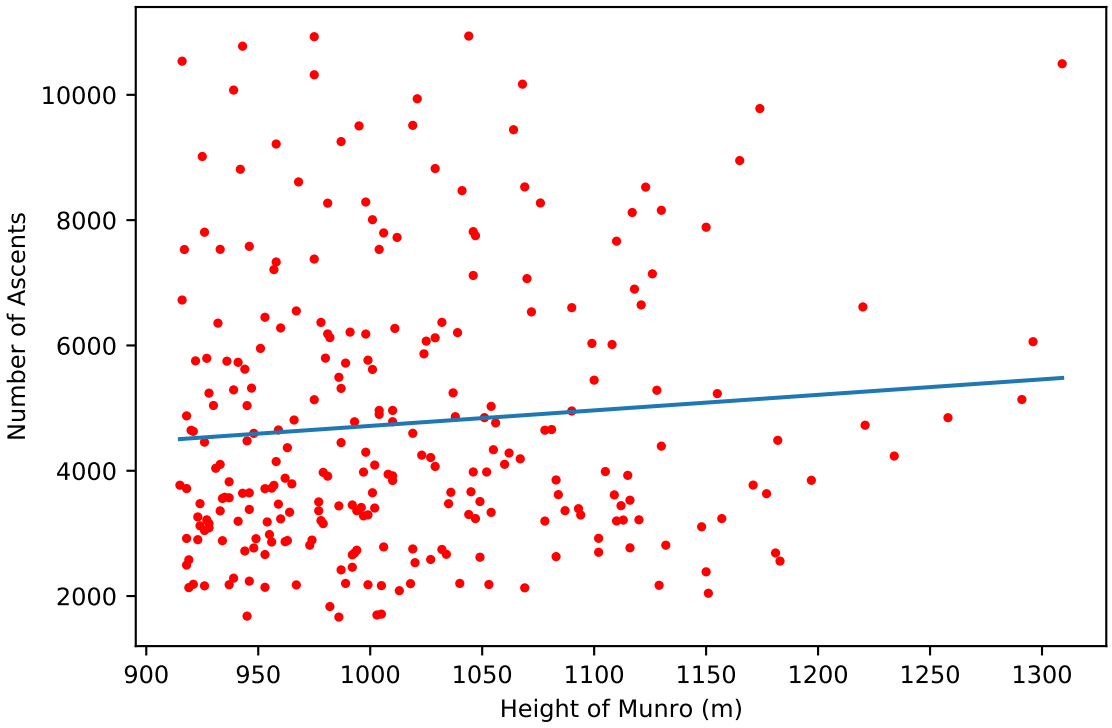

Figure 2: Scattergraph showing the relationship between height of Munro, and the frequency of ascents, with a regression line, with outliers removed

5 Discussion and conclusions

Summary of findings Overall, we found that there is no significant relationship between the height of a Munro and the popularity, and the frequency in which they were climbed. This could be because the popularity of a Munro is multi-factorial, due to distance to cities, easiness to climb, etc. and height is not the only factor that affects people's decisions to climb a Munro.

Evaluation of own work: strengths and limitations The study was important as the link between height of Munros and popularity had not been explored before. The sample size (all he Munros in Scotland) is relatively large so there is greater reliability of results. However, we didn't consider the multi-factorial nature of the cause of popularity of Munro which could make the study less accurate.

There are limitations: first of all the dataset from the Walkinghighlands ascents page could have sampling bias, as visitors of the site would be avid climbers and do not represent the whole population. Furthermore the data is all from people who have logged that they have completed a Munro, they could be lying, or not logging some of their climbs which can make the data unreliable. Another limitation was the lack of prior research studies on the topic, so we started off blind.

Comparison with any other related work Due to the lack of prior research in this area, there ahasn't been much in terms of related work to the subject.

Improvements and extensions To improve this study I would consider other factors which would impact the popularity of a Munro, such as distance from transportation links, easiness of ascent, area etc and create a bigger study with controls for these confounding variables. I would also consider using more reliable data for the popularity of the Munros, by maybe using GPS data from phones.

References

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