Using Visual A.I to check commercial viability

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Abstract—**Most people when they walk around don't notice how many people are around them at a given time, having an idea of how many people are on a specific street along with the time makes a strong combination. The information can be used in a lot of different research and or business needs. The project utilizes Python as its programming language, along with a lot of different libraries. The main library used is imageai for object detection along with a public live-streaming site skyline webcams. The video stream was scraped and saved so that Image AI can process it with the 'retinanet_resnet50' Model with a 30% accuracy minimum. With imageAI, I plotted the total attendance that the street may have by day. I also added another figure which displays the number of people per hour, these two figures can be automatically created by using the program. I found that the easy access to creating a weekly report really helps visualize what the data represents. Visualization of data gives more ease of use for users who can find numbers difficult, having the software be as readable as possible and allowing people to easily is an important part of this paper.**

Index Terms—, , , ,

I. Introduction

With the rising of the economy, more and more people are taking their hard-earned money to start a business to build a foundation for their family. This big step is not an easy one to do so one might check or double-check every single detail before committing since one misstep can cost you money or time which you can't afford. Most new businesses do not succeed however if there is a way to increase those odds then it is natural to grasp at every straw possible, in this paper I put a lot of focus on the location of the potential buyer because it's one of the biggest variables that affect the business. investing in a location is no easy task especially if you need to buy it rather than rent it, committing yourself to one location can be stressful.

Inflation has been wreaking havoc on everyone in the business chain, with inflation people are buying fewer products which reduces the profits. Sadly margins need to be kept so that the store can remain profitable hence why a lot of stores are struggling right now.

II. Literature Review

There are different ways to tackle the problem of counting the people in an image, this paper decided to use the detect and count approach but there is a Density estimation that can be more accurate on more difficult images [1]. This was achieved by creating a Convolutional Neural Network (CNN).

This technique generates a map of density for each pixel which is summed up and counts the people. Every method that uses Visual AI to process it in any way will find one big problem which is the quality of the picture. You can cherry-pick images that will output a good result however images that are low quality, or which have people standing very far away. In these instances, CNN is equipped with two different branches, one which is made for high-density pictures and the other made for low-density pictures.

Object-based counting is a technique that is used in a lot of different industries to help with quality control automatically, without the need for a person. In [2] the researchers outline the framework that most AI models can use, first step is to capture the image. This might come from a video stream or a camera directly, then one can use image enchantments to suit their needs, this step may help with identifying the objects more clearly for the AI step 3 consists of finding similar pixels in a specific area and identifying them as a distinct object. The last step is object counting where you count those distinct objects [2].

Although one can use any image to put into the AI model, enhancing the image will prove to help the outcome. Images can have certain artefacts which can impede the process of counting accurately, reducing those artefacts can help you get more confident in your data. [2] "Objective of image enhancement is to process image so that resulting image is more suitable than original image for specific application"

According to [3] "A comfortable, safe, clean, crowded, and easily accessible business location." are some of the most important factors to determine success in a business. Using every asset in your arsenal to get a gauge of how crowded the street is can be an important factor in choosing what store to buy for a potential buyer. How accessible a business also affects how successful it is, this can mean several things, having a building be physically in a central area will make it more popular since it shortens the time the average person will have to walk to get to your store. This can mean that the store is in between the person's commute which is why having your store on a main street is important. The more exposure that your store has, the more likely the person is to visit it. The same concept is used in advertisements, in most cases they don't expect a direct correlation to sales but they do expect to build an image of the brand. A store that is seen every day will be used as a landmark for people to meet or

Hours	Observed	Counted	Difference	MAE
9	11	12	-1	5.77777777777778
10	16	23	-7	
11	16	30	-14	
12	12	15	-3	
13	11	13	-2	
14	10	13	-3	
15	14	18	-4	
16	16	25	-9	
17	20	29	-9	

for directions.

Establishing a new company can be hard to establish if you do not have a brand, it will be a long journey to have enough exposure for returning customers. Unless it's a chain store which has the advantage of starting with an existing business model and structure, a new business has a lot of uphill battles which it has to battle to achieve profit. A chain business can afford to not get the prime location of a mall, a lower value spot will give them more money to put into inventory or perhaps more time to stay open. Opening a shop in a prime spot can be a heavy burden on rent every month. If the mall is not attracting as many people as you thought it can turn bad quickly. [3]

[4] "The authors were able to determine the success and popularity of existing businesses, difficulty accessing the store location, and peak rush hours" foot traffic is a key part in the puzzle of making a successful business, determining the peak hours and foot traffic of the area can narrow down potential places to own. When one decides to buy a business and or rent a location, the options can be a lot to handle. Having a tool to get the best bang for one's buck is important, it's easy to buy a place in a big mall near the entrance however you can probably find a similar foot traffic area for a cheaper price.

The above table shows the MAE(Mean Absolute Error) of the data collected in the project, compared to the [1] 467 MAE at first glance it seems my data set is better however if you account for scaling [1] crowd CNN deals with a much larger data set which can explain the large discrepancy. The observed column is what the software counted and the counted column is what I manually counted with the same video that the software used.

III. Research Methodology

While deciding to open a business one might go in person to check it out for themselves however, you can't simply stay in the street all day to see the flow of people who might visit your potential store. Having more information at your fingertips can help the average person make a more informed decision. More people who can visit your store also increases the chances of being visited and or noticed.

Information is key when making decisions, With this research one can just set up the same environment and gain the same data as the one obtained in this paper. It would not require a lot of work. The objectives of this paper are the following:

1) Give more information to the potential buyer of the property

2) Identify streets which could be more cost-effective to buy
3) Identify the different Vision techniques which can be used

Research question(s) that this paper is trying to prove

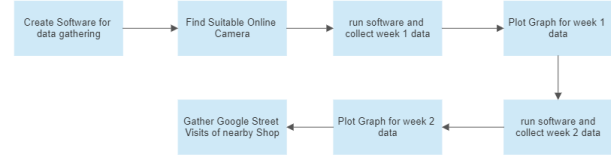1) Is it feasible to use computer vision to evaluate store customer traffic?

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Fig. 1. Research Pipeline

In the research pipeline I put an important emphasis on creating the software at the start of the project, I created the project from the ground up, using different libraries which would work with the final idea. There was a lot of research on the different libraries to use since I had no background in this field. After successfully finishing the prototype I needed a source to pull from, during my testing and building of the prototype I was using a local webcam over Valletta since we are in Malta, however, while preparing to start collecting data the cam went down. Fearing that the data gathering would be interrupted halfway through I opted for another camera. After Searching for a bit I found an Italian camera which had a 45-degree angle that I wanted, it was overlooking a busy street and there were shops nearby. After the software and camera were all set it's all about starting the program and ending it at the right times While plotting the graph at the end of the week. at the end of the 2-week gathering of data, I went on google maps to get what Google expected the people visiting to be to compare with my results.

With the data compiled, I can output a graph with the total visitors per hour so that I can give accurate data to the potential buyer. If you repeat this process with another webcam you should have two different data sets that you can compare with each other so that the client can form an opinion as to which shop should have more foot traffic. One should put the price of the potential restaurant and or store into account as well, foot traffic alone should not be the sole variable in buying.

IV. Findings & Discussion of Results

The software developed has been mostly reliable, I chose to start and stop the program rather than use automated means. This decision was made to make sure that I don't lose a whole week of constant data. While conducting the data gathering there was a small hiccup during the first week, the program was not set to gather the 5-6 pm data, however, this was fixed in the 2nd week.

During the data gathering the program stopped on Wednesday in both weeks I still could not find what made the program

stop on the same day however I can still convey the message of the paper.

While watching the results coming in I noticed that the Image Recognition library was missing a lot of people resulting in false negatives, the program was catching the majority of the people however it was missing a quarter of the walking people on the street. Implementing an image process which transforms the image to be more clear for the Image Recognition library would help increase the accuracy of the true positives.

2 The data collected shows that in the street

Via Goffredo Mameli in Italy has a general trend that the visiting time spike during the 10 to 11 Am times, that is according to the data collected however one of the two places which are on the street have conflicting results. The shop Tezenis clothes shop 3 seems to have the same trend as what I have seen which lines up perfectly. This sudden influx of people at around 11 to 12 am which then calms down in the afternoon, after that short break it quickly picks up at 4-5 pm this information is collected by Google which is not perfect and it's not consistent. On the same street, there are another business names La Taverna Pizza 4 and it shows that there is only one apex in its graph, it only spikes at 1 pm which leads then it slows down dramatically.
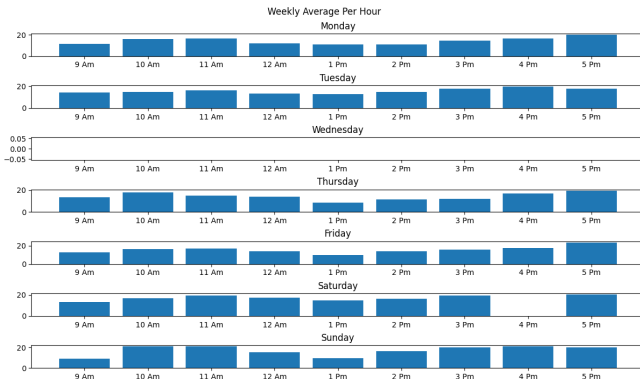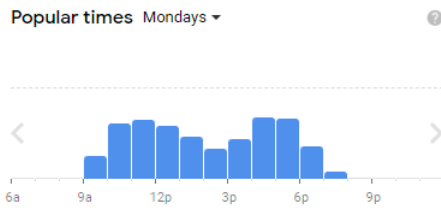

Fig. 2. Week2

Fig. 3. Tezenis clothes shop Same street Google Visitor on Monday

V. CONCLUSION

For this research, the main focus of what the paper wishes to achieve is to make buying a property a bit easier by giving more information to the buyer. The question I'm trying to answer is if it is feasible to use computer vision to evaluate store customer traffic, with this paper I managed to provide
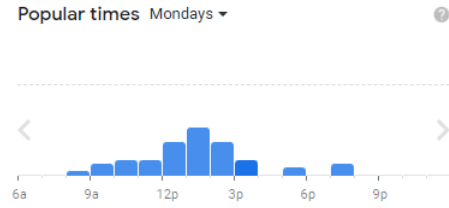

Fig. 4. La Taverna pizza Same street Google Visitor on Monday

the client with the traffic in the area by day along with the total amount of people. With this information, they can have a ballpark number of what could the ROI(return on investment) be. With the current set-up I have made it could work on a small street with good camera quality however if you start to introduce more variables like rain, high-density crowds and winter-type clothes a different kind of vision technology is to be used. However, with the small test completed the data collected seems to be mostly right in proving that one can set up this system, and after a week of progress, he/she can be expected to know how many people were in the street. If I could restart the prototype I would use a CNN approach rather than object counting since it seems to be more appropriate to accurately identify people in crowds. A multi-street approach would have been better if possible, to increase the data collected along with more different technologies that can be used.

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APPENDIX A
SUPPORTING MATERIAL

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ACKNOWLEDGEMENT

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