Framework for Customer Behavior Tracking Within

Retail Stores

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# Introduction

In order to maximize the amount of products sold, supermarkets have used dated marketing philosophies to place products around their stores for efficient selling. Although these philosophies have proven moderately successful, they fail to acknowledge the evolving needs of customers and the change in their buying psychologies. Because customer needs and behaviors are constantly changing, a dynamic solution must be presented to adapt product placements based on these evolving changes. With the advancement of store surveillance systems coupled with object detection software, it has proven to be much more effective to use customized customer traffic and trajectory-based solutions to determine the optimum placement for products within retail stores. The idea behind these systems has been developed in many research papers spanning the field of Computer Science and Marketing alike, but only recently has the technology been available to efficiently study and implement these systems on a large scale.

Previously, many implementations of this concept have been applied and researched. These include works by Hernandez et al., S.Peker et al., and several others to be discussed in the upcoming sections. Having proven to be effective systems, the proposed solutions did not provide business owners with clear, easily digested reports on the proper proposed placement of products.

The proposed framework being presented would solve the problems past research has failed to solve, building upon stronger object detection algorithms, providing interactive reports for retail store owners, and customizing each shelf based on a virtual, interactive dashboard amongst many other further plans. This complete system would provide retail store owners with the correct evidence to support a new, dynamic solution to product placement within their stores. The system would be non-invasive to the store, needing only access to the footage from the store’s CCTV cameras, meaning its installation is easier on retail store owners, bypassing and physical intrusions.

# Related Work

With the rise of technological advancements in the Artificial Intelligence field, many notable research bodies of work have been conducted to further analyze visual customer behavior streams. Among the key works in this domain is the paper published on Research Gate and titled *Customer Analysis via Video Analytics: Customer Detection with Multiple Cues[[1]](#footnote-0)*. It discussed the implementation of the DbScan and Markov models in order to focus on the timings and repetitiveness of events. It explores additional cues for customer detection through context, prior knowledge and sensory input such as videos. The framework proved a success for the business establishment with a 42% increase in performance.

Furthermore, another study titled *How Computer Vision Provides Physical Retail[[2]](#footnote-1) with a Better View on Customers* collects insight through customer trajectory from entry to exit. A mapping of the physical story is utilized in order for to monitor item placements. The research suggested the use of the YOLO algorithm alongside additional optimization efforts; such as positioning and improved shelving procedures. Many papers in this topic however discuss the limitations of such analysis when it comes to customer privacy or data breaches. Certainly there exists a solution to these shortcomings given the beneficial value.

In addition, extensive research is mandatory to take place in order to achieve the most optimized results for our framework. The following related work, titled *An empirical comparison of customer behavior modeling approaches for shopping list prediction[[3]](#footnote-2)* compares different customer behavior modeling approaches for predicting purchases. It incorporates for instance multiple methods for segmentation in order to select the most accurate modeling approach. It is fixated on utilizing three features which are “average inter-purchasing time”, “average basket size” and “product variety”. Many models are discussed and examined in this paper which proves to be valuable for the preliminary research of the framework’s demo and future implementation.

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*a**b* 

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* In American English, commas, semicolons, periods, question and exclamation marks are located within quotation marks only when a complete thought or name is cited, such as a title or full quotation. When quotation marks are used, instead of a bold or italic typeface, to highlight a word or phrase, punctuation should appear outside of the quotation marks. A parenthetical phrase or statement at the end of a sentence is punctuated outside of the closing parenthesis (like this). (A parenthetical sentence is punctuated within the parentheses.)
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* There is no period after the “et” in the Latin abbreviation “et al.”.
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An excellent style manual for science writers is [7].

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Text heads organize the topics on a relational, hierarchical basis. For example, the paper title is the primary text head because all subsequent material relates and elaborates on this one topic. If there are two or more sub-topics, the next level head (uppercase Roman numerals) should be used and, conversely, if there are not at least two sub-topics, then no subheads should be introduced. Styles named “Heading 1”, “Heading 2”, “Heading 3”, and “Heading 4” are prescribed.

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1. Table Type Styles

| **Table Head** | **Table Column Head** | | |
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| ***Table column subhead*** | ***Subhead*** | ***Subhead*** |
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1. Sample of a Table footnote. (*Table footnote*)
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Figure Labels: Use 8 point Times New Roman for Figure labels. Use words rather than symbols or abbreviations when writing Figure axis labels to avoid confusing the reader. As an example, write the quantity “Magnetization”, or “Magnetization, M”, not just “M”. If including units in the label, present them within parentheses. Do not label axes only with units. In the example, write “Magnetization (A/m)” or “Magnetization {A[m(1)]}”, not just “A/m”. Do not label axes with a ratio of quantities and units. For example, write “Temperature (K)”, not “Temperature/K”.

##### Acknowledgment *(Heading 5)*

The preferred spelling of the word “acknowledgment” in America is without an “e” after the “g”. Avoid the stilted expression “one of us (R. B. G.) thanks ...”. Instead, try “R. B. G. thanks...”. Put sponsor acknowledgments in the unnumbered footnote on the first page.

##### References

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For papers published in translation journals, please give the English citation first, followed by the original foreign-language citation [6].

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2. D. A. Mora Hernandez, O. Nalbach and D. Werth, "How Computer Vision Provides Physical Retail with a Better View on Customers," 2019 IEEE 21st Conference on Business Informatics (CBI), Moscow, Russia, 2019, pp. 462-471, doi: 10.1109/CBI.2019.00060. [↑](#footnote-ref-1)
3. S. Peker, A. Kocyigit and P. E. Eren, "An empirical comparison of customer behavior modeling approaches for shopping list prediction," 2018 41st International Convention on Information and Communication Technology, Electronics and Microelectronics (MIPRO), Opatija, Croatia, 2018, pp. 1220-1225, doi: 10.23919/MIPRO.2018.8400221. [↑](#footnote-ref-2)