Paper Title*

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***Abstract*—This document is a model and instructions for LaTeX. This and the IEEEtran.cls file define the components of your paper [title, text, heads, etc.]. *CRITICAL: Do Not Use Symbols, Special Characters, Footnotes, or Math in Paper Title or Abstract.**

***Index Terms*—component, formatting, style, styling, insert**

I. Introduction

An increasing number of convenience stores as well as medium-scale and small-scale supermarkets appears in our surroundings. To make a long-term profit, retailers desire to keep their overall cost as low as possible in terms of management, labor, logistics and properties. News: home depot yearly labor cost 90,444 million. costco yearly logistics cost 10,444 million. warehouse, amazon, alibaba Walmart, home depot, caref, costco,

amazon robot https://www.youtube.com/watch?v=cLVCGEmkJs0

end-user Meanwhile, a concept of "cashier-free supermarket" is proposed in nowadays, which draws much public attention. The number of unmanned supermarkets is increasing, and it is becoming an emerging business model in the future, for an instance, the novel idea of Take it awayas announced by Amazon Go. Amazon Go, Sam's Club Now and Taocafe are three pioneers that jump into the "cashier-free supermarket" technology and make it come true. Amazon Go already started 5 unmanned stores in U.S. and they are planning to open up to 1000 stores till 2020. Sensors and camera scan detect the categories and quantities of the products that a customer takes. Moreover, with a proper camera layout, more integrated information can be gathered to strengthen our estimation of the quantitative variation of the products [1]. Camera monitoring the purchasing behavior is an important part in a "cashier-free supermarket", and the change from a traditional supermarket to an advanced supermarket can be achieved by upgrading the capabilities and layouts of cameras, to provide an identification feature. This paper will discuss the techniques of the modern cameras, mainly about device layouts, items category identification and quantity counting. [update todo]

The rest of this paper is structured as follows: Section II xxxx Section II xxxx xxxx in Section II.

Identify applicable funding agency here. If none, delete this.

II. Related Works

Amazon Go and Sam's Club Now are two popular retailers in unmanned supermarket. Amazon Go stores use a combination of sensors on the shelves, cameras and computer vision with machine learning. Different from Amazon Go, Sam's Club pays more attention to camera layout aiming to plan shopping routes, and it use RFID [2]. In our experiment, we learnt from both retailers, and we set camera layout first, then use computer vision and sensors to identity the category and quantity of the items.

A. Camera layout

In order to lower the overall cost of the sellers and economize resources, we aim to use the less cameras to cover whole scene while the clearest image can be obtained. We compare the camera layout of various supermarkets and chose one of the best-functioned layouts of cameras for our experiment, which use multi cameras and each camera is responsible for a specific area. We can get all the information in this areaand image obtained for each region are processed separately []. We try to adjust the Field of View (FOV) aiming to ensure both, camera coverage maximizing and image clarity [1].

B. Computer vision

Two popular computer visions are YOLO and Faster-RCNN [3] [4]. Both of them have strong recognition ability. Faster-RCNN is a technology for using CNN to research feature map, and RPN network will complete the full operation of the map before send it to box regression layer and taxonomy

[3]. YOLO input SS grid, and every gird is responsible for the objects falling into it, then it can choose the maximal IOU of bounding box [4]. YOLOv3 is chosen in our experiment since in processing medium-scale and small-scale supermarkets, it is based on Open Source Computer Vision Library(OpenCV) and Compute Unified Device Architecture(CUDA). OpenCv is used to images processing, and CUDA is used to call GPU to accelerated operation.

C. Weight sensor

Amazon Go use the weight sensors as an assistant to determine the number of items on the shelves.

III. Technical comparison

A. official tones

Amazon Go officials stressed that they could use computer vision, sensor fusion, and deep learning to make peoples shopping more convenient. The store concept is considered as a revolutionary model which relies on the prevalence of smartphones and geofencing technology to streamline the customer experience, as well as supply chain and inventory management [**?**] .

B. end-user comments

According to some end-user comments, the existence of trans-era science and technology changes our consumption pattern. However, some people think it makes shopping a hassle since Amazon Go omitted the need for closing account by human, and it is hard for the aged to use smartphone.

ESL: electronic shelf label small fontsize for elderly people

60yrs age grandma. samsclub , membership fee. self check-out on smartphones. reduce cost, incurring burden onto customers.

younger adults, students no line, quick, smartphone

proofread

C. Maintaining the Integrity of the Specifications

The IEEEtran class file is used to format your paper and style the text. All margins, column widths, line spaces, and text fonts are prescribed; please do not alter them. You may note peculiarities. For example, the head margin measures proportionately more than is customary. This measurement and others are deliberate, using specifications that anticipate your paper as one part of the entire proceedings, and not as an independent document. Please do not revise any of the current designations.

IV. Prepare Your Paper Before Styling

Before you begin to format your paper, first write and save the content as a separate text file. Complete all content and organizational editing before formatting. Please note sections IV-A–IV-E below for more information on proofreading, spelling and grammar.

Keep your text and graphic files separate until after the text has been formatted and styled. Do not number text heads—LaTeX will do that for you.

A. Abbreviations and Acronyms

Define abbreviations and acronyms the first time they are used in the text, even after they have been defined in the abstract. Abbreviations such as IEEE, SI, MKS, CGS, ac, dc, and rms do not have to be defined. Do not use abbreviations in the title or heads unless they are unavoidable.

B. Units

- Use either SI (MKS) or CGS as primary units. (SI units are encouraged.) English units may be used as secondary units (in parentheses). An exception would be the use of English units as identifiers in trade, such as "3.5-inch disk drive".
- Avoid combining SI and CGS units, such as current in amperes and magnetic field in oersteds. This often leads to confusion because equations do not balance dimensionally. If you must use mixed units, clearly state the units for each quantity that you use in an equation.
- Do not mix complete spellings and abbreviations of units: "Wb/m^2" or "webers per square meter", not "webers/m^2". Spell out units when they appear in text: ". . . a few henries", not ". . . a few H".
- Use a zero before decimal points: "0.25", not ".25". Use "cm^3", not "cc".)

C. Equations

Number equations consecutively. To make your equations more compact, you may use the solidus (/), the exp function, or appropriate exponents. Italicize Roman symbols for quantities and variables, but not Greek symbols. Use a long dash rather than a hyphen for a minus sign. Punctuate equations with commas or periods when they are part of a sentence, as in:

$$a + b = \gamma \tag{1}$$

Be sure that the symbols in your equation have been defined before or immediately following the equation. Use "(1)", not "Eq. (1)" or "equation (1)", except at the beginning of a sentence: "Equation (1) is . . ."

D. LaTeX-Specific Advice

Please use "soft" (e.g., `\eqref{Eq}`) cross references instead of "hard" references (e.g., `(1)`). That will make it possible to combine sections, add equations, or change the order of figures or citations without having to go through the file line by line.

Please don't use the `{eqnarray}` equation environment. Use `{align}` or `{IEEEeqnarray}` instead. The `{eqnarray}` environment leaves unsightly spaces around relation symbols.

Please note that the `{subequations}` environment in LaTeX will increment the main equation counter even when there are no equation numbers displayed. If you forget that, you might write an article in which the equation numbers skip from (17) to (20), causing the copy editors to wonder if you've discovered a new method of counting.

BIBTEX does not work by magic. It doesn't get the bibliographic data from thin air but from .bib files. If you use BIBTEX to produce a bibliography you must send the .bib files.

LATEX can't read your mind. If you assign the same label to a subsubsection and a table, you might find that Table I has been cross referenced as Table IV-B3.

LATEX does not have precognitive abilities. If you put a `\label` command before the command that updates the counter it's supposed to be using, the label will pick up the last counter to be cross referenced instead. In particular, a `\label` command should not go before the caption of a figure or a table.

Do not use `\nonumber` inside the `{array}` environment. It will not stop equation numbers inside `{array}` (there won't be any anyway) and it might stop a wanted equation number in the surrounding equation.

E. Some Common Mistakes

- The word "data" is plural, not singular.
- The subscript for the permeability of vacuum μ_0, and other common scientific constants, is zero with subscript formatting, not a lowercase letter "o".
- 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.)
- A graph within a graph is an "inset", not an "insert". The word alternatively is preferred to the word "alternately" (unless you really mean something that alternates).
- Do not use the word "essentially" to mean "approximately" or "effectively".
- In your paper title, if the words "that uses" can accurately replace the word "using", capitalize the "u"; if not, keep using lower-cased.
- Be aware of the different meanings of the homophones "affect" and "effect", "complement" and "compliment", "discreet" and "discrete", "principal" and "principle".
- Do not confuse "imply" and "infer".
- The prefix "non" is not a word; it should be joined to the word it modifies, usually without a hyphen.
- There is no period after the "et" in the Latin abbreviation "et al.".
- The abbreviation "i.e." means "that is", and the abbreviation "e.g." means "for example".

An excellent style manual for science writers is [].

F. Authors and Affiliations

The class file is designed for, but not limited to, six authors. A minimum of one author is required for all conference articles. Author names should be listed starting from left to right and then moving down to the next line. This is the author sequence that will be used in future citations and by indexing services. Names should not be listed in columns nor group by affiliation. Please keep your affiliations as succinct as possible (for example, do not differentiate among departments of the same organization).

G. Identify the Headings

Headings, or heads, are organizational devices that guide the reader through your paper. There are two types: component heads and text heads.

Component heads identify the different components of your paper and are not topically subordinate to each other. Examples include Acknowledgments and References and, for these, the correct style to use is "Heading 5". Use "figure caption" for your Figure captions, and "table head" for your table title. Run-in heads, such as "Abstract", will require you to apply a style (in this case, italic) in addition to the style provided by the drop down menu to differentiate the head from the text.

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.

H. Figures and Tables

a) Positioning Figures and Tables: Place figures and tables at the top and bottom of columns. Avoid placing them in the middle of columns. Large figures and tables may span across both columns. Figure captions should be below the figures; table heads should appear above the tables. Insert figures and tables after they are cited in the text. Use the abbreviation "Fig. 1", even at the beginning of a sentence.

TABLE I
TABLE TYPE STYLES

Table Head	**Table Column Head**		
	Table column subhead	***Subhead***	***Subhead***
copy	More table copy[a]		

[a]Sample of a Table footnote.

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".

Fig. 1. Example of a figure caption.

ACKNOWLEDGMENT

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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[3] S. Ren, K. He, R. Girshick, and J. Sun, “Faster r-cnn: Towards real-time object detection with region proposal networks,” in *Advances in Neural Information Processing Systems 28*, C. Cortes, N. D. Lawrence, D. D. Lee, M. Sugiyama, and R. Garnett, Eds. Curran Associates, Inc., 2015, pp. 91–99. [Online]. Available: http://papers.nips.cc/paper/5638-faster-r-cnn-towards-real-time-object-detection-with-region-proposal-networks.pdf

[4] J. Redmon and A. Farhadi, “Yolov3: An incremental improvement,” *arXiv*, 2018.