

# Machine Perception Assignment One

Due Date: Week 10 - Monday 5 October 2020 at 5pm

Kwaramba, Tawana (19476700)

Faculty Of Science And Engineering: School of Civil And Mechanical Engineering

Curtin University

Bentley WA, Australia

19476700@student.curtin.edu.au

**Abstract**—write at this at the end of your report :)

**Index Terms**—Histograms, I don't know what this is tbh...

## I. INTRODUCTION

do this are the end

## II. TASK ONE: IMAGE HISTOGRAM, HARRIS CORNERS AND SCALE-INVARIANT FEATURE TRANSFORM (SIFT) KEY POINTS

The Harris corner detection algorithm, and the SIFT algorithm can be thought of algorithms which will pick the key features of an image with the pre-dominate implementations of these algorithms detect the corners of the image [2] [3]. Corners can be thought of as regions in an image with large variation of intensities in all directions [2]. Therefore, the SIFT and the Harris algorithm, are algorithms for detecting the corners in an image the key differences is the invariance and variance to certain image transformations [3]. Harris corner detection algorithm is mainly invariant to rotation, and the SIFT algorithm is mainly invariant to scaling and is also invariant to rotations due the orientation assignment stage of the SIFT algorithm [3], which is explored in greater detail in section III subsection III-A.

### A. Harris corner detection

The Harris corner detection is an algorithm whereby a window function will scan through the image to locate local maximums, these local maximums can be thought as potential candidates for key features detected by the Harris corner detection algorithm [4] [2]. This following behaviour can be modelled by the following equation:

$$E(u, v) = \sum_{(x, y)} w(x, y) [I(x + u, y + v) - I(x, y)]^2 \quad (1)$$

Whereby:

- $w(x, y)$  represents the window which is scanning over each section of the image,
- $I(x + u, y + v)$  represents the intensity neighbouring pixels, and
- $I(x, y)$  represents the intensity of the current pixel.

Thereafter, the function is through Taylor expansion to form the following system of equations

$$E(u, v) \approx [u \ v] M \begin{bmatrix} u \\ v \end{bmatrix} \quad (2)$$

Harris corner detection is an algorithm which can be mainly thought as a rotation invariant algorithm meaning, no matter the angles you rotate a given image, the algorithm is going to detect the same key-features \*. This is due to that a corner will always go to remain a corner no matter what orientation the image is \*. Albeit, if you zoom into a corner, the corner may appear like a flat edge inside the respective window function this concept is clearly demonstrated in **have the image of the zoomed up corner** \*.

### B. SIFT

## III. TASK TWO: IMAGE FEATURES

an example on how to reference other sections IV

### A. part ii

## IV. TASK THREE

## V. TASK FOUR

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.

L<sup>A</sup>T<sub>E</sub>X 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.

#### A. Some Common Mistakes

- The word “data” is plural, not singular.
- The subscript for the permeability of vacuum  $\mu_0$ , 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 [?].

#### B. 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).

#### C. 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.

#### D. 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 <sup>a</sup>		

<sup>a</sup>Sample of a Table footnote.



Fig. 1. Example of a figure caption.

**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

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. How is this going to work

## REFERENCES

- [1] Dr. S. An. 2020. Machine Perception Lecture 03 [PowerPoint slides] Available:[https://learn-ap-southeast-2-prod-fleet01-xythos.s3.ap-southeast-2.amazonaws.com/5dc3e34515a0e/4348643?response-cache-control=private%2C%20max-age%3D21600&response-content-disposition=inline%3B%20filename%2A%3DUTF-8%27%27lecture03\\_feature\\_detection.pdf&response-content-type=application%2Fpdf&X-Amz-Algorithm=AWS4-HMAC-SHA256&X-Amz-Date=20200927T060000Z&X-Amz-SignedHeaders=host&X-Amz-Expires=21600&X-Amz-Credential=AKIAYDKQORRYZBCCQFY5%2F20200927%2Fap-southeast-2%2Fs3%2Faws4\\_request&X-Amz-Signature=bcf107d5e76759efe45687b516ac725158189de0af558d0a7a798df1723f4299](https://learn-ap-southeast-2-prod-fleet01-xythos.s3.ap-southeast-2.amazonaws.com/5dc3e34515a0e/4348643?response-cache-control=private%2C%20max-age%3D21600&response-content-disposition=inline%3B%20filename%2A%3DUTF-8%27%27lecture03_feature_detection.pdf&response-content-type=application%2Fpdf&X-Amz-Algorithm=AWS4-HMAC-SHA256&X-Amz-Date=20200927T060000Z&X-Amz-SignedHeaders=host&X-Amz-Expires=21600&X-Amz-Credential=AKIAYDKQORRYZBCCQFY5%2F20200927%2Fap-southeast-2%2Fs3%2Faws4_request&X-Amz-Signature=bcf107d5e76759efe45687b516ac725158189de0af558d0a7a798df1723f4299)
- [2] A. Mordvinste and K. Abid. "Harris Corner detection". OpenCV-Python Tutorials. [https://opencv-python-tutroals.readthedocs.io/en/latest/py\\_tutorials/py\\_feature2d/py\\_features\\_harris/py\\_features\\_harris.html](https://opencv-python-tutroals.readthedocs.io/en/latest/py_tutorials/py_feature2d/py_features_harris/py_features_harris.html) (retrieved Sept. 27, 2020).
- [3] . OpenCV. "Introduction to SIFT (Scale-Invariant Feature Transform)". OpenCV-Open source Computer vision. [https://docs.opencv.org/3.4/da/df5/tutorial\\_py\\_sift\\_intro.html](https://docs.opencv.org/3.4/da/df5/tutorial_py_sift_intro.html)
- [4] . C. Harris and M. Stephens. 1988. A Combined Corner And Edge Detector. Plessey Reasearch Roke Manor, UK. [Online]. Available: <https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.434.4816&rep=rep1&type=pdf>