

## **Cooperative Education Report**

**Effect of grasping uniformity on estimation of  
grasping region from gaze data  
At Software Measurement and Analytics  
Laboratory of Okayama University**

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## **Abstract**

This report is a part of Cooperative Education at Software Measurement and Analytics Laboratory of Okayama University, which I spend time from June to July as an intern.

I was responsible for the maintenance of data of those who come to experiment and bring data to analytics.

I was assigned to develop a graphical user interface in Java for annotation of several properties of the data set used in experiments investigating the effect grasping motivation on gaze behavior.

I've have learned many things from this Cooperative Education such as Data analysis, and how to use Python. In addition, I've learned real work experience. This internship help me to be a disciplined person and about responsibility towards the assignments.

## **Acknowledgement**

I had cooperative education opportunity with Software Measurement and Analytics Laboratory of Okayama University from June 2019 to July 2019. I am grateful for being given an internship opportunity at Okayama University.

I would like to thank Kasetsart University for arranging this cooperative education opportunity for me. I am also thankful for Okayama University for accepting my cooperative education request.

I express my deepest thanks to Akito Moden, Professor of Okayama University for arranged all facilities to make my life easier, and Zeynep Yucel, Assistant Professor of Okayama University, for giving me necessary advice and helping me to solve the problem and taking care of me so well.

Finally, I am very thankful to my family, my friends and members in Lab. for all their support during this cooperative education period.

Ms. Pimwalun Witchawanitchanun  
Reporter

**The last date of co-op**

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# Chapter 1

## Introduction

### 1.1 Motivations and Importance

Humans-robot collaboration is a relatively new field. It would be interesting if humans and robots could work together by interacting with each other and doing manual tasks. Therefore, I used this cooperative education opportunity for studying gaze behavior of humans over graspable objects, and evaluated estimation performance of grasping regions from gaze data.

### 1.2 Objectives

1. To learn about data analysis.
2. To put programming skills in practice.
3. To apply knowledge from classroom to real work.
4. To prepare for the actual work in the future.

### 1.3 Scope of Work

In this cooperative education, I was assigned to develop an application in Java for the purpose of annotating several properties of graspable objects.

### 1.4 History and Detail of Company

Software measurement and analytics laboratory at Okayama University 1-1, Tsushima-Naka, 3-chome, Kita-Ku, Okayama, Japan.

The software measurement and analytics laboratory was started in April 2015. It focuses on measurement and analysis of software processes and products of large software development.

#### **Organization and management model**

Their research topics include software quality analysis, cost estimation, project monitoring, human factors in software development, software security and protection.

#### **Position or work detail**

I was responsible for the maintenance of data of those who come to experiment and bring data to analytics.

#### **Name and position of student's supervisor**

Akito Monden as Professor.

Zeynep Yucel as WTT (Woman Tenure Truck) Assistant Professor.

**Internship/cooperative education period**

From 3 June 2019 to 31 July 2019

**1.5 Expected Benefits**

I expected to get experience in data engineering and develop my programming skills.

## **Chapter 2**

### **Background Knowledge and Related Work**

#### **2.1 Background Knowledge**

##### **- Java development skill**

Java is the main programming language used in this cooperative education. Java was first released by Sun Microsystems in 1995 and since then it has been an important component in various applications and websites. Java is used in laptops, game console, scientific supercomputers, cell phones etc. and is considered to be fast, secure, and reliable.

##### **- Human-robot collaboration**

Human-robot collaboration is the study of collaborative processes between humans and robotic agents, which work together to achieve shared goals. Numerous recent applications require robots to work alongside humans as capable members of human-robot teams. Some applications include robots for homes, hospitals, and offices, space exploration and manufacturing.

#### **2.2 Related Work**

- In literature, there exist various studies aimed at discovering grasping affordances from gaze. Among those, several studies investigate the effect of familiarity of objects and the intention of the subjects (lifting or using) [1], readiness to act [2], as well as the effect of center bias on gazing and its evolution over time [3] and distribution of gaze over functional and manipulative parts of “tools” [4]. The findings indicate that manipulative ends are gazed more often and this effect becomes stronger, provided that the subject is familiar with the object [1], is ready to act [2], and has the intention of “using” rather than “lifting” [1].



(i) A well-defined graspable part such as a handle (i.e. grasping region is expected to be “uniform” across different graspers).

(ii) An intuitive region for grasping, even if they do not have a well-defined handle/grip (i.e. grasping region is expected to be “somewhat uniform” across different graspers.).

(iii) Neither a grip nor an intuitive grasping region (i.e. grasping region is expected to vary largely across different graspers.).

We present these options to our coders and ask them to label each image with one option or select another alternative as ‘I do not know’.

As a result of this coding process, objects such as a mug, scissors are labeled as type-(i), whereas objects like bottle or toothpaste are labeled as type-(ii), objects like shoes, vegetables are labeled as type-(iii) .

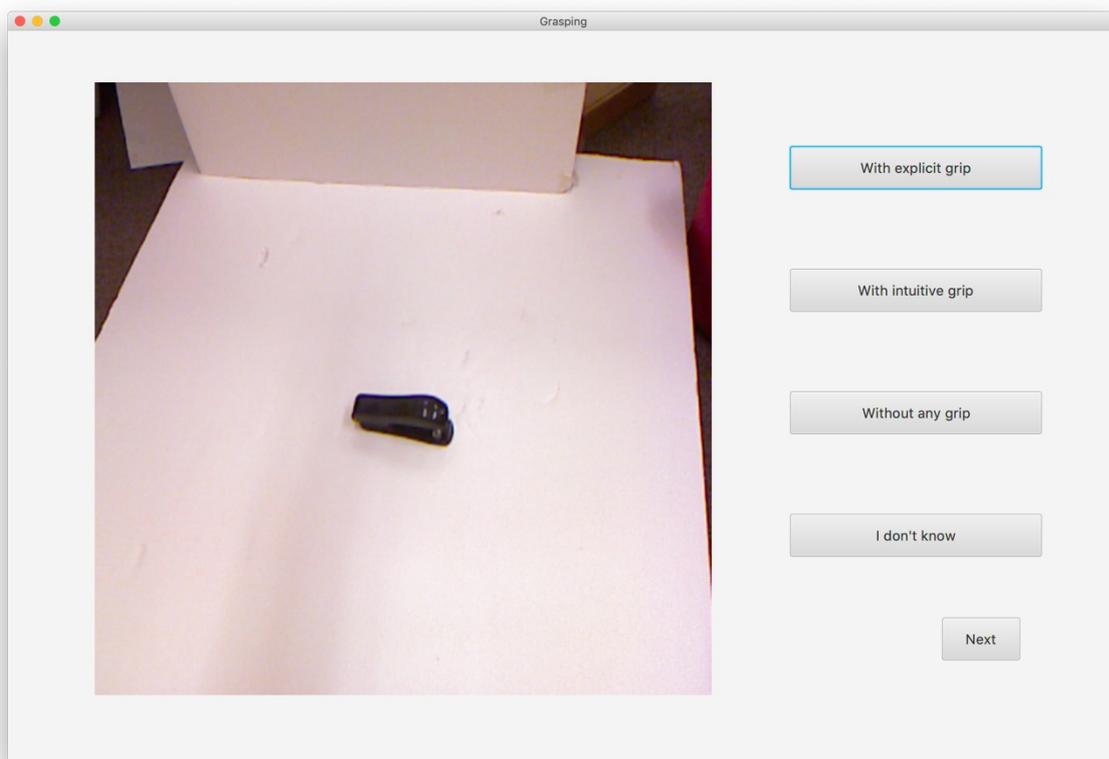


Figure 2: User interface of grasping uniformity.

### **Flowchart of the annotation software for labeling grasping uniformity**

Program starts by receiving a string of inputs, composed of user name and clip number. The clip number is used for get image file names. These images are displayed one by one with the four options alongside (see Figure 2.). For each image, user chooses a single option and proceeds to the next image by pressing “**Next**” button. If the user is not satisfied with his/her choice, he/she can press “**Previous** ” button and make a new selection. User cannot proceed, unless he/she chooses one of the four options. Finally, the codings are logged into a text file after the last image is annotated. After the program ends, it has 1 file in a directory with the same name as the user.

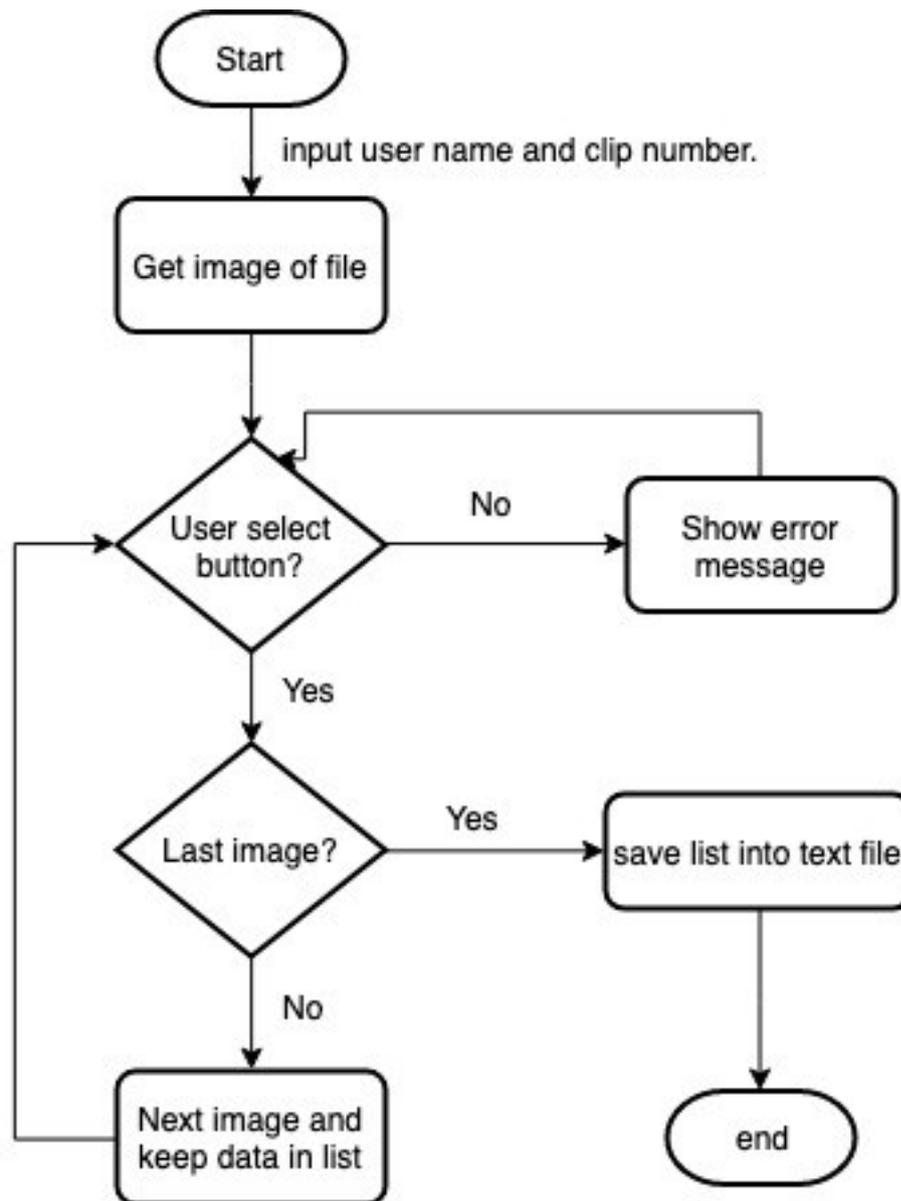


Figure 3: Java program flowchart of grasping uniformity.

**Coding of grasping regions:** “Learning to grasp” data set involves annotations of grasping regions on 2D image plane (defined as quadrilaterals). However, since the data set is aimed at robot grasping, there are some grasping regions in the ground truth, which are unconventional for humans (e.g. open blades of scissors or tip of a screwdriver, etc.). Therefore, we collected another set of ground truth annotations regarding grasping region. Namely, a single grasping region (imagining the grasper is a human) is labeled on each image in a similar way to original labeling (i.e. as a quadrilateral.)

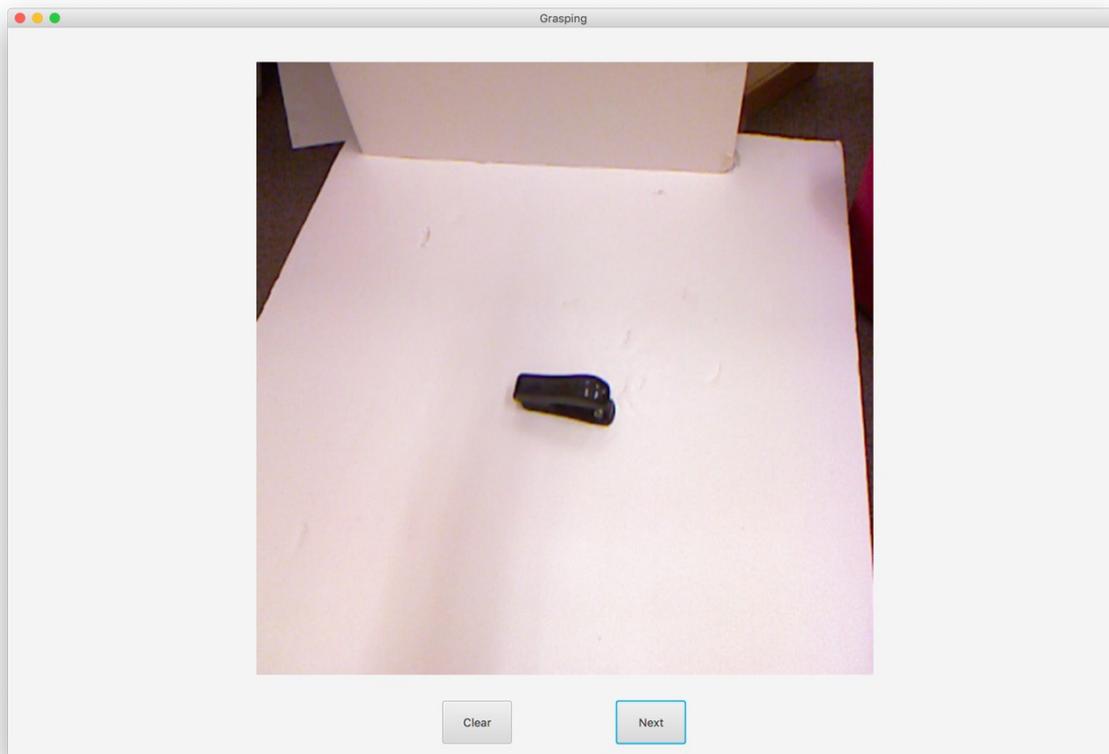
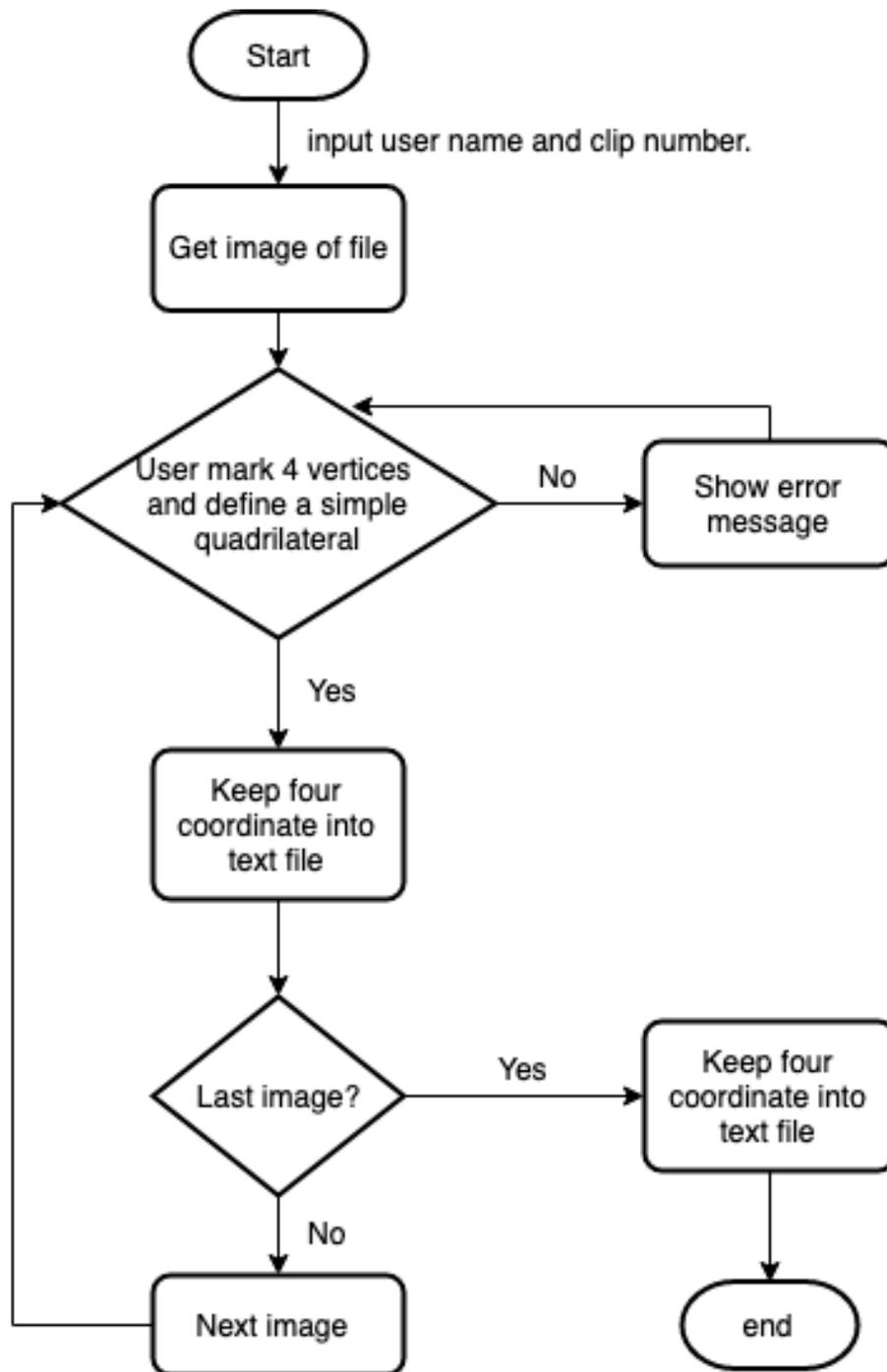


Figure 4: Example of grasping regions.

### **Flowchart of the annotation software for labeling grasping regions**

Program starts by receiving a string of inputs composed of user name and clip number. User marks 4 vertices on the image and proceeds to the next image by pressing “**Next**” button. If the user is not satisfied with the annotated region, he/she can press “**Clear**” button and make a fresh start. User cannot proceed, if he/she marks less than 4 vertices or does not define a simple quadrilateral. A set of four coordinates are saved into a text file. After the program ends, it has 36 files under a directory with the same name as the user.



### - Tools

**Eclipse:** The Java IDE for Professional developer.

**Draw.io:** Program to drawing flowchart.

## Chapter 4

### Results and Analysis

#### 4.1 Results

Type	Motivated			Not-Motivated			$\Delta J$
	$t_i$	$t_m$	$t_f$	$t_i$	$t_m$	$t_f$	
(i)	13	17	21	25	28	26	35
(ii)	26	29	24	31	30	35	16
(iii)	14	12	17	13	21	21	18

Table 1:

#### 4.2 Analysis

- Discuss and analyze the results

# Chapter 5

## Conclusion

- Conclude your work
- Expectation
- Benefits
  - Benefits to yourself
  - Benefits to company
  - Benefits to university
- Swot analysis (of yourself)
- Impressive experience / special experience

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# Chapter 6

## Problems and Comments

### Student

#### Problems

1. ....

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2. ....

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#### Comments

1. ....

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2. ....

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### Company

#### Problems

1. ....

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2. ....

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#### Comments

1. ....

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2. ....

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### University

#### Problems

1. ....  
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2. ....  
...

Comments

1. ....  
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2. ....  
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## References

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[0] Java 8: Oracle, 2018. Available <https://docs.oracle.com/javase/8/docs/api/> [Accessed on: 29 July 2019].

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## **Appendix A**

### **Daily Reports**

#### **Date 3/6/2019**

Read and try to understand paper of senior “Effect of motivation on gaze behavior over time”

#### **Date 4/6/2019**

Find image in data set, find the amount of unique objects, find the amount of grasping rectangle per image and find the amount of grasping rectangle per object.

# Appendix B

## Workplace Photos

Date .....

Activities: .....

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