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|  | **COMSATS Institute of Information Technology,**  **­­­­­­ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Campus** |

**Synopsis** for the degree of M.S./M.Phil. Ph.D.

**PART-1** (to be completed by the student)

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| Name of Student | | Muhammad Usman Sarwar | | |
| Department | | Computer Science | | |
| Registration No.  SP18-RCS-027 | | Date of Thesis Registration | | February 2019 |
| Name of  (i) Research Supervisor  (ii) Co - Supervisor | | 1. Dr. Wajahat M Qazi   (ii) Jan Rosell | | |
| Members of Supervisory Committee | | | | |
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| 3. |  | | | |
| 4. |  | | | |
| Title of Research Proposal | | | Task-Oriented Grasping For Manipulation. | |
| Signature of Student: | | | | |
| Summary of the Research  *100 to 125 Words*  Font: Times New Roman, Size 11  Kitchen ware objects will be collected and preprocessed to pass GRASPIT simulator. Using GRASPIT simulator data will be marked labels using multi-model classifier [1] have developed in our conference paper. This study purposed approach to develop a model that can generate an action-oriented semantic grasp for an object using different Machine learning techniques. That techniques will be analyzed against training and testing phase. Best machine learning techniques will be selected as suitable on the basics of performance against accuracy score in testing phase. | | | | |

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| *Introduction*  *(This includes introduction to the problem, motivation behind solving the problem and related work. Minimum number of references for related work should be at least 10, out of which 50% must be from last 5 years)*  *250 to 300 words.*  *Font: Times New Roman, Size 11*  Classical Approaches focus to hold the object in such a way that it should not drop from robot griper. Robot grasping is so far from computing a suitable grasp from a particular task. It still a challenge to compute a grasp of given image of observation of an object [1]. Robotics community has focused to develop two types of models. 1) Grasp Models to determine grasping point that is suitable for picking up an object. 2) Task Models assume the grasp is already stable on the object and focus on modeling the motion that realize the task [2]. For the action-oriented grasping, the requirements to fulfill the action related restrains depend on the type of the action and the object geometry and are therefore difficult to take a broad view. This study is interest to develop a model that allow to robot grasp the unseen object in such a way that can execute a given task. In previous studies, Grasp will be consider stable if Object has hold in such a way that it should not drop from robot griper. A stable grasp may be valid for grasping the particular action pick to clean and the same grasp may be not valid for the action pick to pour due to action restrain. This study will learn techniques to develop Semantic oriented Grasp model that will know to grasp an object for a particular action. |
| Statement of the Problem  *(This includes the problem being addressed by the thesis and its scope)*  One paragraph of 50~80 words  Font: Times New Roman, Size 11  This study purposes a task-oriented grasping G for manipulation where a Model M will be developed for robot-gripper R that will learn grasping G for particular action against graspable object in the robot workspace. Many proposed approaches objective is to predict the single best grasp from an image. Previous methodologies grasp an object and they don’t predicts whether an action is valid or not against a particular task, but this proposed methodology will alsopredicts whether an action is a valid or not against a particular task. An object that will grasp a pose may be valid for cleaning, but there is a possibility that it might not be valid for pour. Model M will take Action a ∈ A and o ∈ O and generate a set grasps g ∈ G. |
| Research Methodology  *(This includes methodology to be used quantitative or qualitative, also provide algorithm flowchart or pseudo code. Please mention what evaluation criteria will be used).*  Max 200 words excluding figures and pseudo code, flowcharts.  Font: Times New Roman, Size 11  For this problem, we will collect a dataset of 3D mesh files from internet. All mesh files will converted into .iv format using Mesh Lab and KAUTHAM tools because GRASPIT read .iv files. GRASPIT will generate 70,000 grasps for each mesh. Top 30 grasps will be selected from 70,000 grasps. After this step labels will be marked for valid and invalid grasp against a particular grasp. Subsequently, some machine learning models will be used for training such large datasets. Best machine learning model will be selected after doing testing. After model selection, mesh file and specific task will be given as input to GRASPIT for classifying whether an input is valid or not. |

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| Bibliography  *(Use IEEE standard referencing style)*  <http://www.ieee.org/documents/ieeecitationref.pdf>   1. Ud Din, M., Sarwar, M. U., Zahoor, I., Qazi, W. M., & Rosell Gratacòs, J. (2019). Learning Action-oriented grasping for manipulation. 2. Johns, E., Leutenegger, S., & Davison, A. J. (2016, October). Deep learning a grasp function for grasping under gripper pose uncertainty. In *2016 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)* (pp. 4461-4468). IEEE. 3. Detry, R., Papon, J., & Matthies, L. (2017, September). Task-oriented grasping with semantic and geometric scene understanding. In *2017 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)* (pp. 3266-3273). IEEE.   Font: Times New Roman, Size 11 |
| Tentative Time Table  *(Identify major milestones and deliverables along with schedule)*  Font: Times New Roman, Size 11 |

**PART II**

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| Recommendation by the Research Supervisor  Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Signature \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date\_\_\_\_\_\_\_\_\_\_\_ |
| Signed by Supervisory Committee   |  |  |  |  | | --- | --- | --- | --- | | S. # | Name of Committee Member | Designation | Signature & Date | | 1 |  |  |  | | 2 |  |  |  | | 3 |  |  |  | | 4 |  |  |  | |

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| **Approved by Departmental Advisory Committee**  Certified that the synopsis has been seen by members of DAC and considered it suitable for putting up to BASAR.  Secretary  Departmental Advisory Committee  Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Signature:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  Chairman/HoD: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  Signature: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  Date : \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |

**PART III**

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| **Dean, Faculty of Information Sciences & Technology**  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Approved for placement before BASAR.  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Not Approved on the basis of following reasons  Signature \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| **Secretary BASAR**  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Approved from BASAR.  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Not Approved on the basis of the following reasons  Signature: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| **Dean, Faculty of Information Sciences & Technology**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  Signature:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |

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| Please provide the list of courses studied  *(This must be provided on a separate Page)* |