Capstone Project

Dr. Fujian Yan

Assistant Teaching Professor
School of Computing, Wichita State University
Office: Jabara Hall 222
Office (student) hours: M 13:00-15:00
fujian.yan@wichita.edu

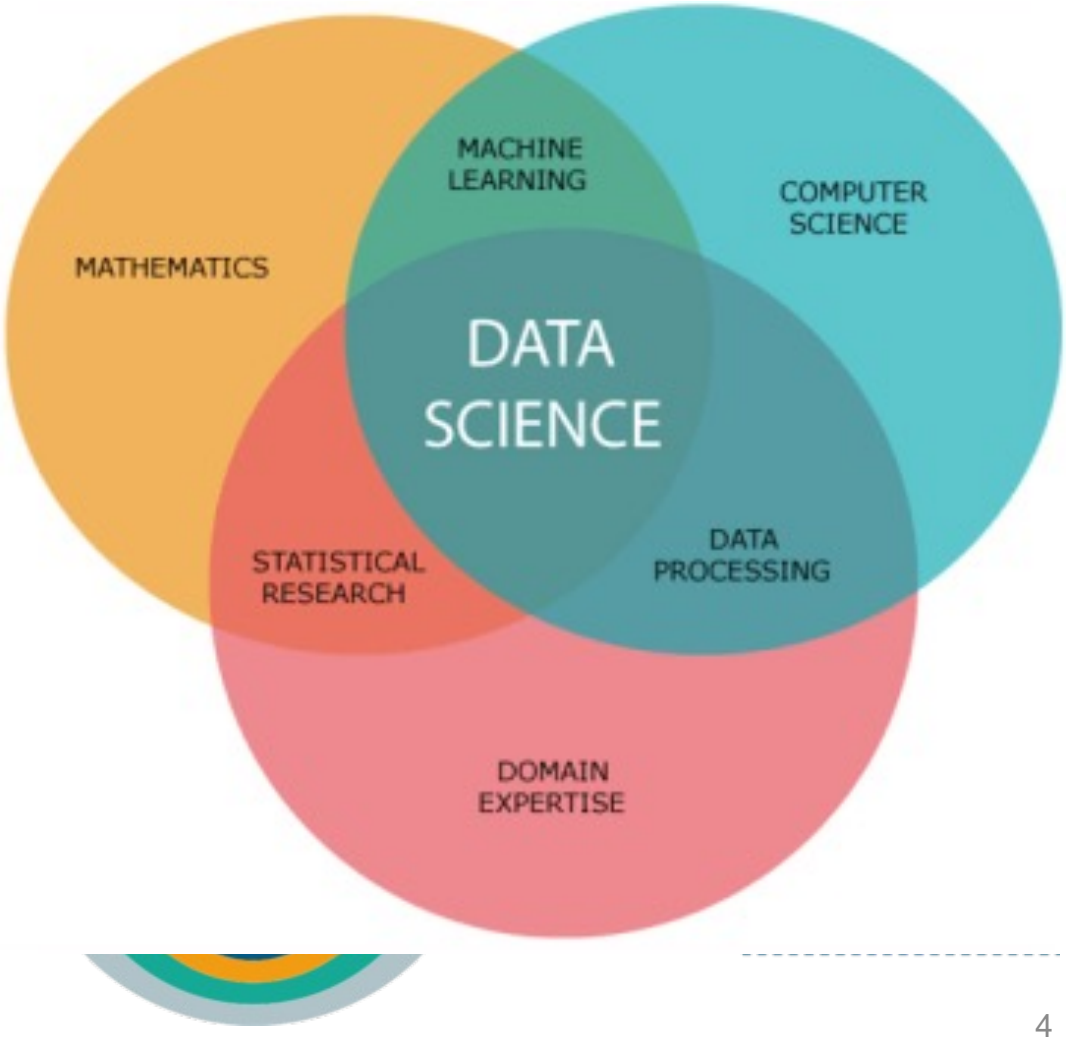
Outlines

- Introduction to Data Science
- Data Security & Datasets
- Syllabus
- Background Quiz

INTRODUCTION TO DATA SCIENCE

Data Science Vs Machine Learning

- Data science is a field that studies data and how to extract meaning from it.
- Machine learning is a field devoted to understanding and building methods that utilize data to improve performance or inform predictions.



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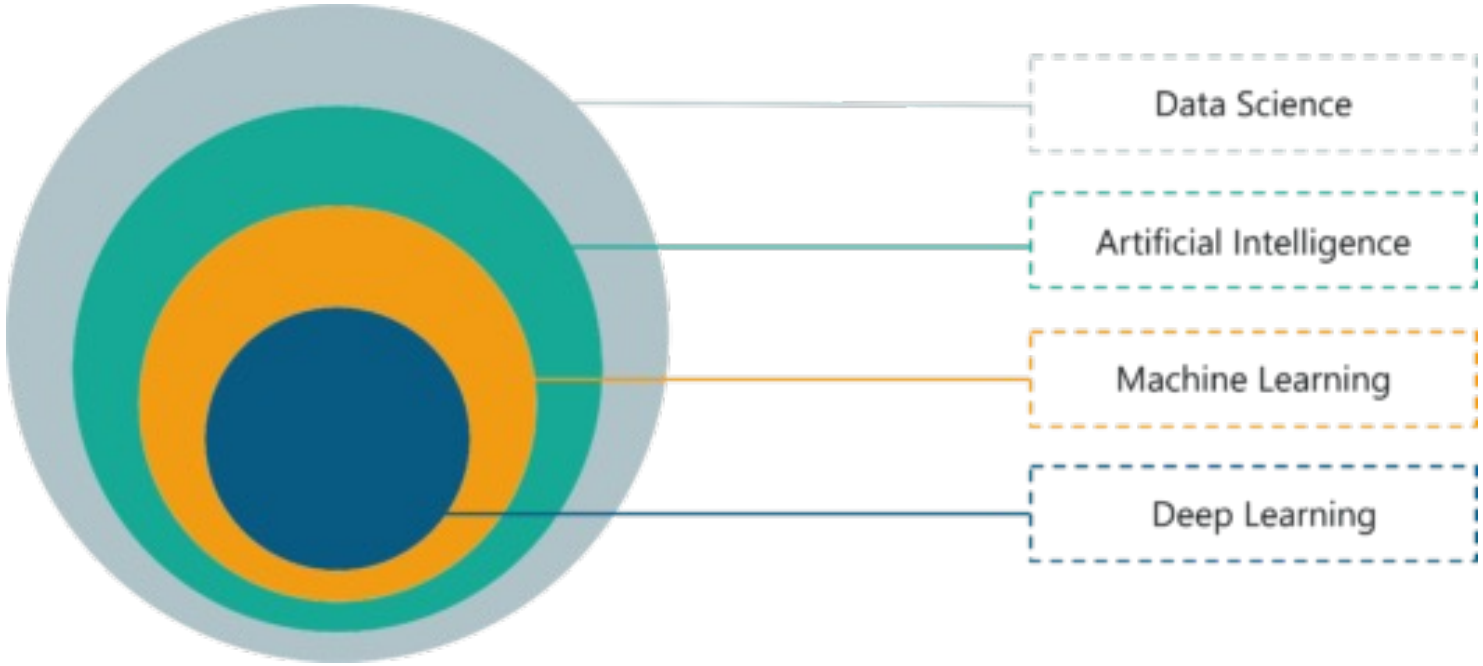
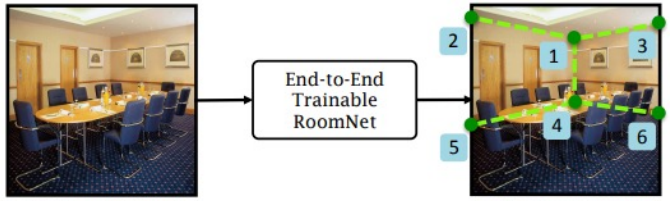


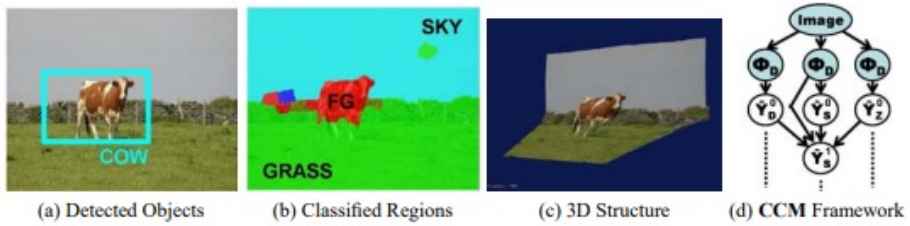
Background

- Semantic Scene Understanding
  - A meaningful combination of multiple objects, environments, and contexts.
  - Bottom-up Sematic Scene Understanding (Gupta, Arbeláez et al. 2015)

  - Top-Down Semantic Scene Understanding (Lee, Badrinarayanan et al. 2017)

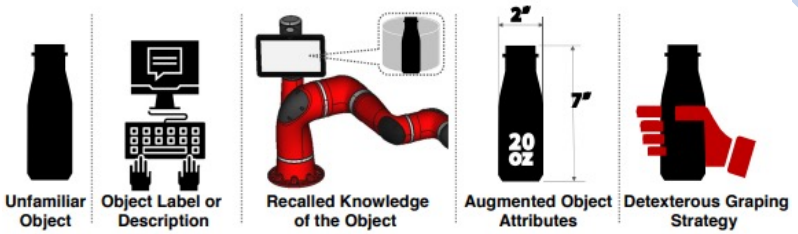


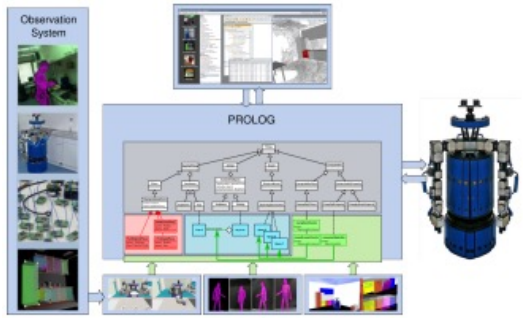
  - Holistic Scene Understanding (Heitz, Gould et al. 2008)

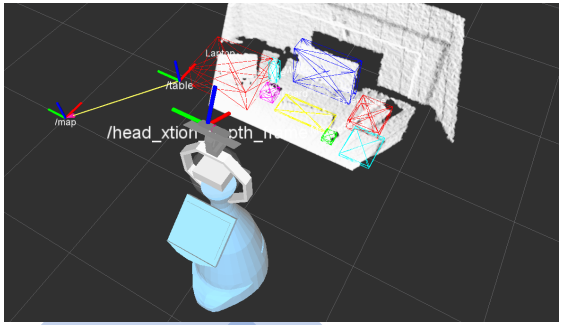


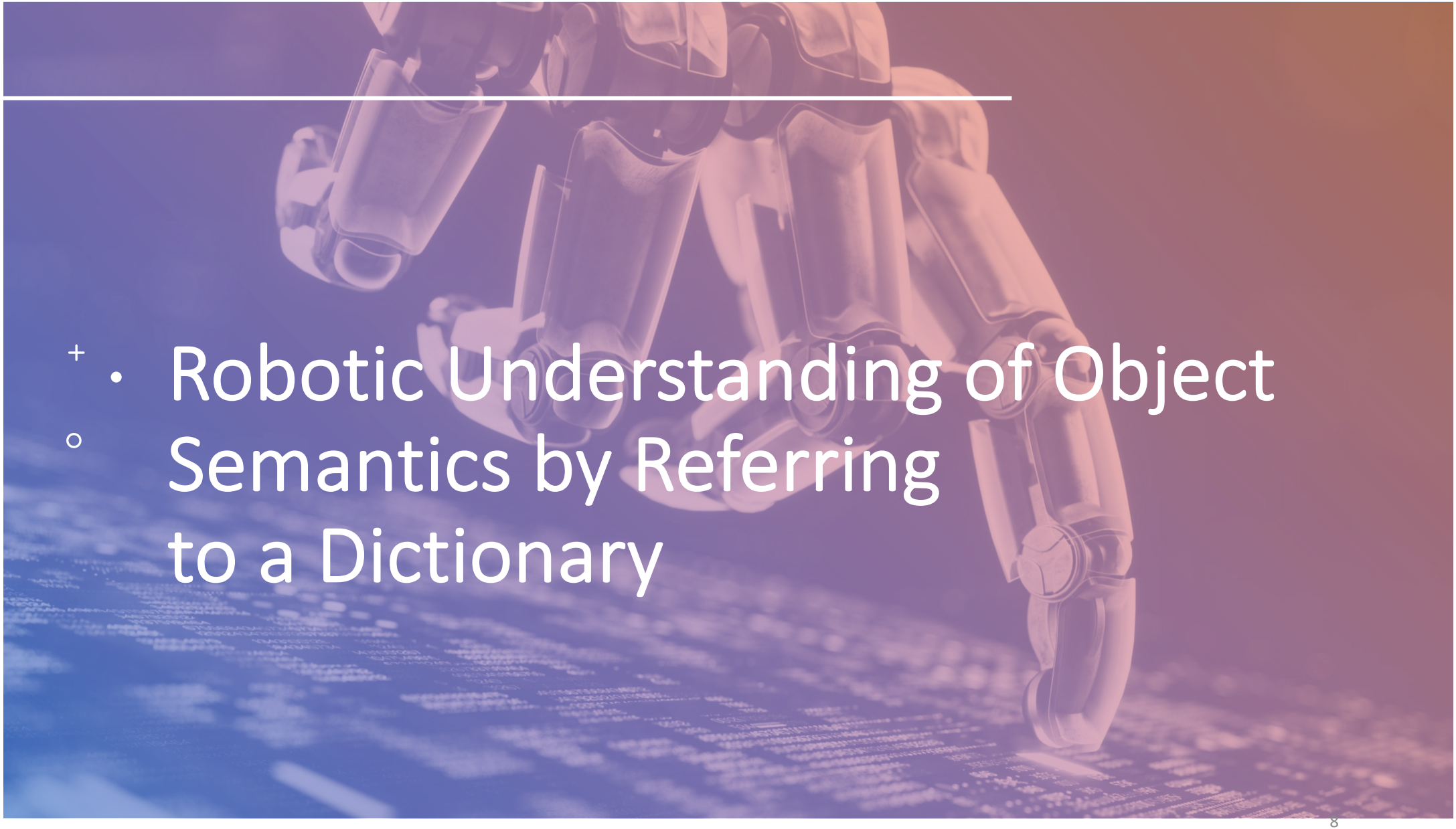
Needs for Robotic Scene Understanding

- **Semantic Scene Understanding for Intelligent Robotics:**
  - Intelligent robots are human companions and assistants
  - To perceive the surrounding objects and the scene
- **Robots need a good scene description:**
  - Object-level semantic scene understanding for robotic application (Rao, Krishnan et al. 2018)
  - Logic relations between detected labels (Tenorth, Nyga et al. 2010)
  - Spatial Constraints between objects (Mees, Abdo et al. 2017)





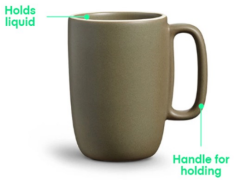




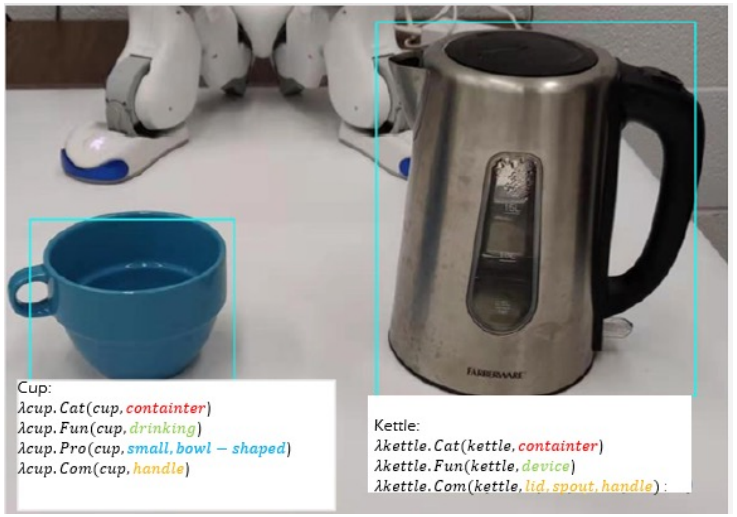
Robotic Understanding of Object Semantics by Referring to a Dictionary

Object Semantic Understanding

- **Object Affordance:**
  - Robot can do with objects

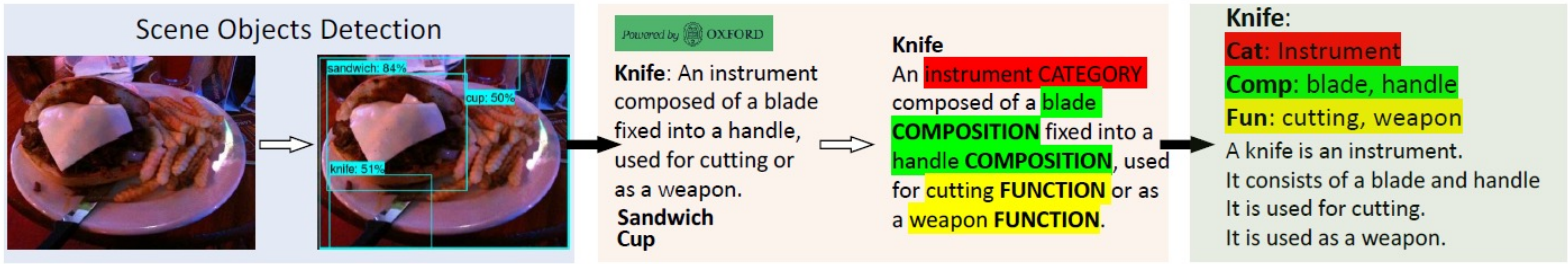


  - Human can reason additional information besides the labels.
  - Human can refer to dictionaries while facing unknown objects.
  - Human can extract information from dictionary to describe objects.

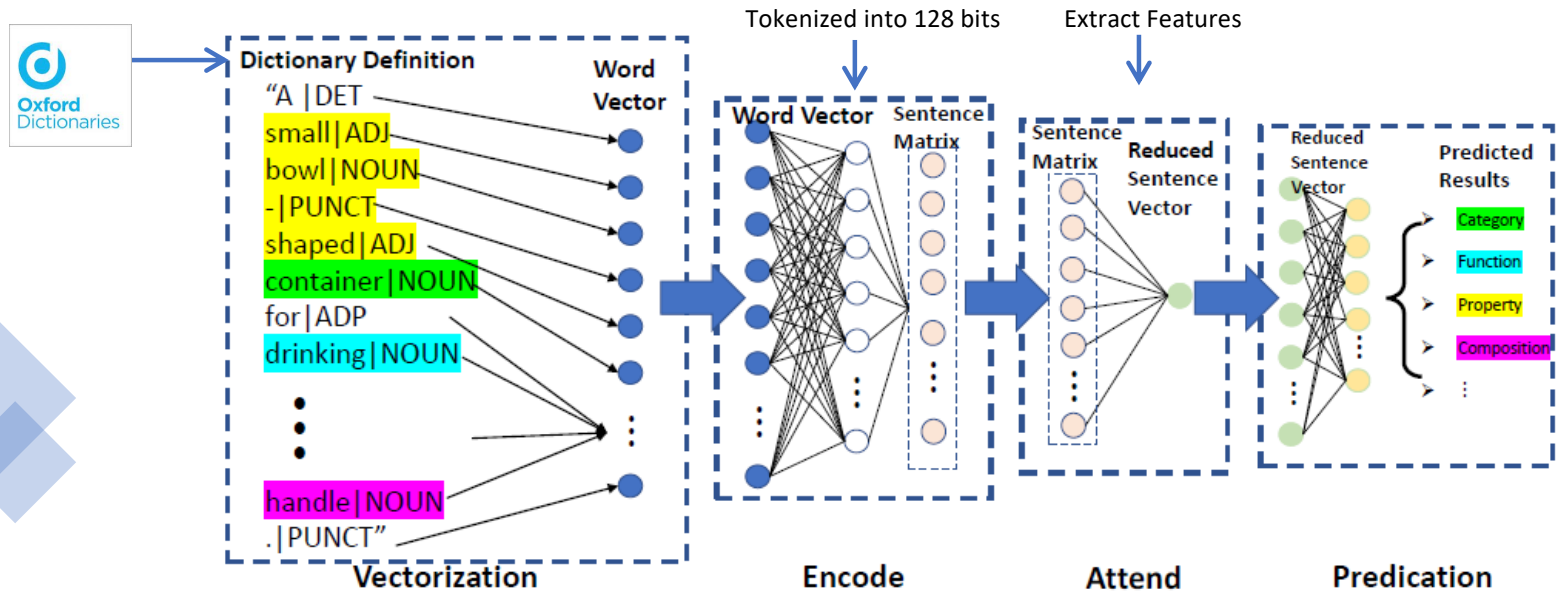


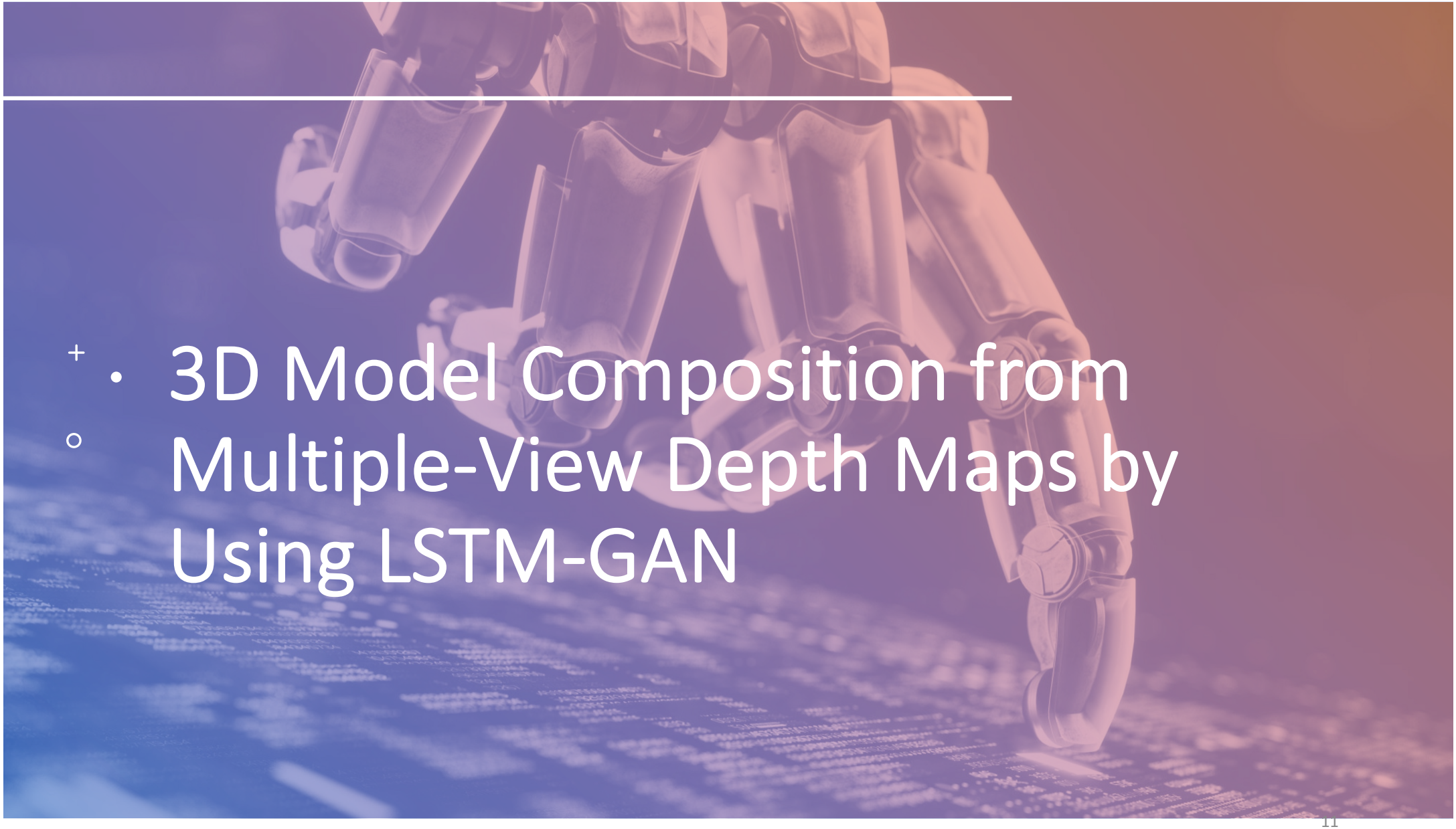
- **Related work**
  - Visual Relation Detection (Wu, Wu et al. 2018)
  - Employed visual appearance model (Lu, Krishna et al. 2016)
  - No deep understanding of labels. (Tenorth, Nyga et al. 2010)

Method: Object Affordance Detection



- Network Structure

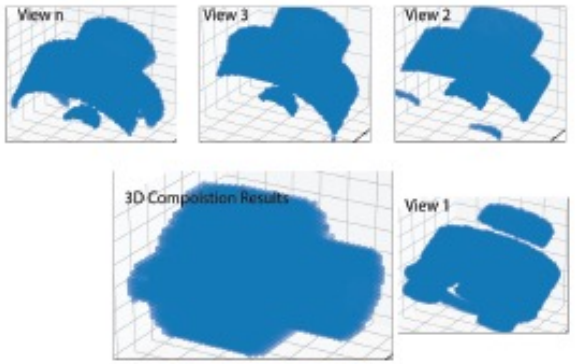


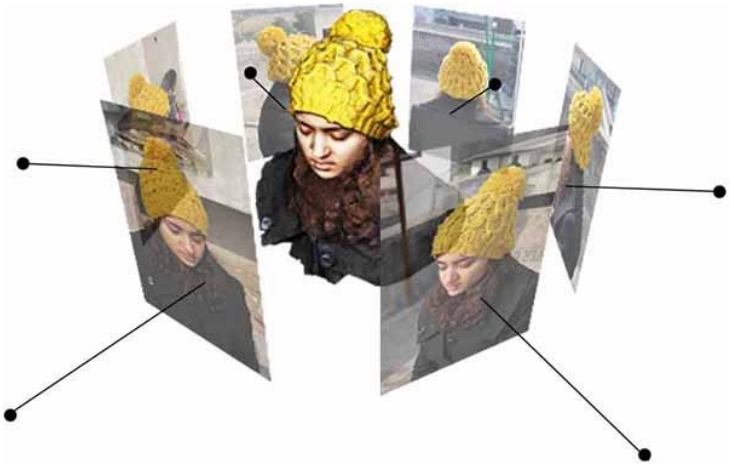


3D Model Composition from Multiple-View Depth Maps by Using LSTM-GAN

Introduction: 3D Composition Background

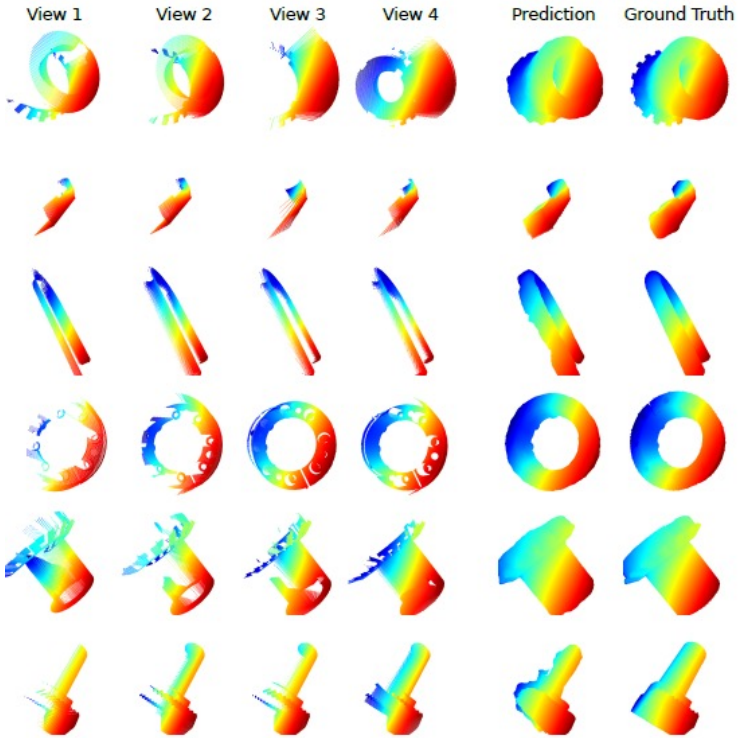
- 3D model of object is informative but cannot obtain easily:
  - Robot grasping
  - Obstacle Avoidance
  - 3D model is informative such as shape, volume, and pose
  - Cannot obtain 3D model easily.
    - Unable to list all objects in the scene
- Related Work
  - RGB-D sensor fusions (Bylow, Sturm et al. 2013)
  - Limitations of previous research:
    - Required a dense number of views (Choy, Xu et al. 2016)
    - Scanning quality of these dense number of views (Dai, Ruizhongtai Qi et al. 2017)
    - Limited by the environments (Wu, Wang et al. 2017)



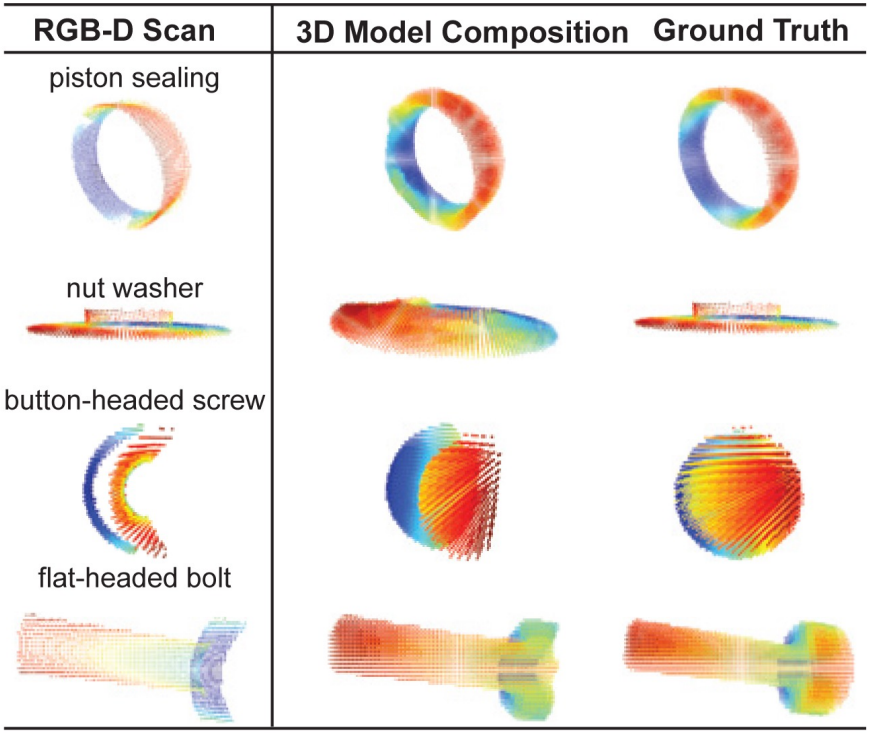


Experiment: Simulation Results

Multiple-View 3D composition results



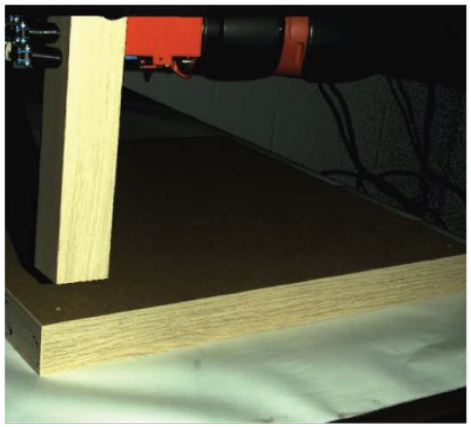
Single-View 3D composition results



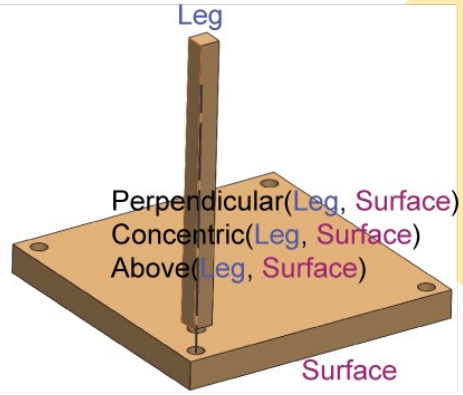
- Comprehension of Spatial Object Relations

Comprehension Spatial Relations

- Understanding spatial relations are important:
  - To represent the scene
  - To assist in designing strategies, such as manipulation
- Related Work:
  - Infeasible to represent all objects (Guadarrama, Riano et al. 2013)
  - No effective way to describe the spatial relations between objects (Mees, Abdo et al. 2017)
- In this chapter:
  - A neural-logic learning model is designed to learn comprehensive spatial constraints using raw point cloud data.

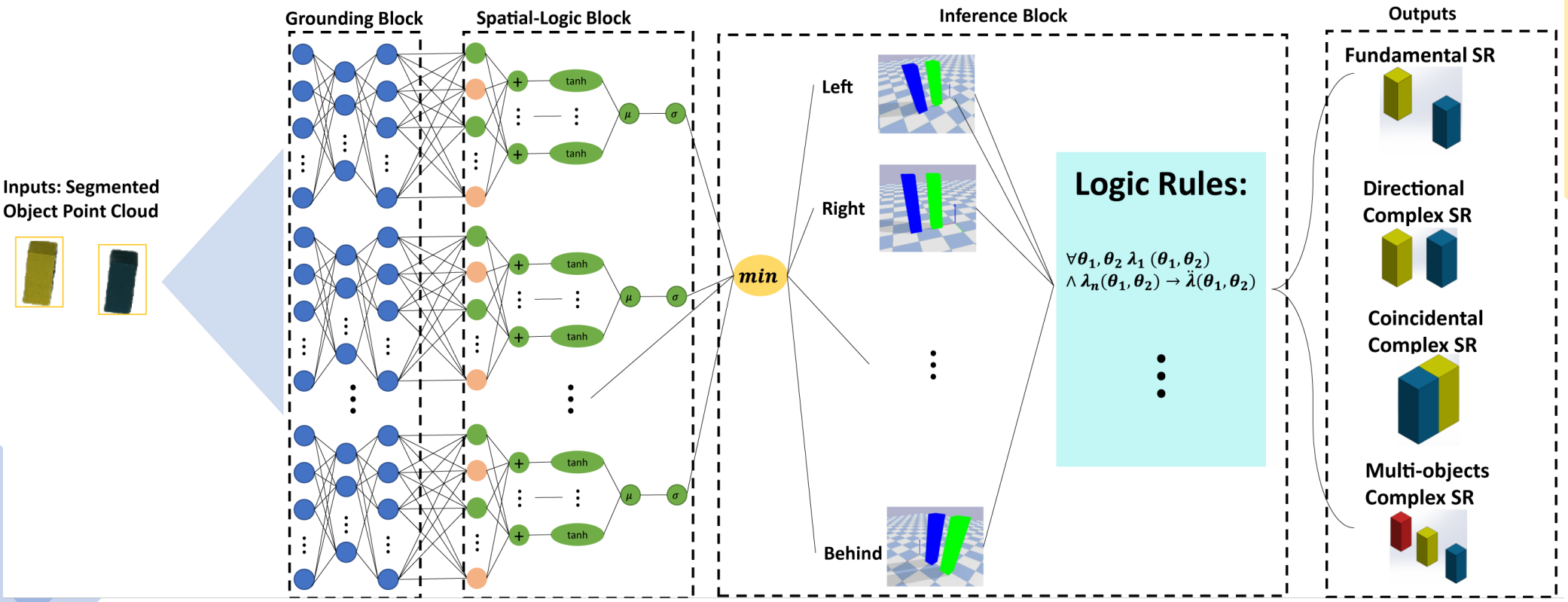


RGB-D Image of the Scene



Comprehended Results

Method: Neural-Logic Network



DATA SECURITY

Data Security Meaning

- Data Security Meaning:
  - Not losing your data
  - Not having your data accessed or changed by an unauthorized person
  - Controlling access to sensitive data
  - Knowing who has accessed and modified the data
  - Preserving data and documentation for future understanding and reproducibility

Data Classifications

- **Data - information collected to be examined and considered and used in decision-making, research, and analysis**

- Level 1: Confidential Information - data which, if shared broadly could cause financial loss, legal liability, public distrust, and/or general harm
  - Ex: Names, Social Security Numbers, National Security information, Grades, Passwords
- Level 2: Sensitive Information - data which, if released would pose moderate risk of loss, liability, distrust, or harm
  - Ex: Email addresses, Competitive business information, Partial addresses
- Level 3: Public Information - data which either poses little to no risks or which is already public knowledge
  - Ex: Sports scores, Weather data, Anonymized donation records, Delivery routes

Data Handling Procedures

- Determine How Much Protection your Information Needs
- Collect Only What is Necessary
- Provide Minimum Necessary Access
- Disclose Only the Minimum Necessary Information
- Safeguard Information in Transit
- Secure Physical Equipment and Resources
- Safeguard Information in Storage
- Dispose of Information Securely When No Longer Needed
- Stay Informed About Information Risks
  - **The KDSC has taken care of many sections for you already**

You are responsible for

- Determine How Much Protection your Information Needs
- Collect Only What is Necessary
- Provide Minimum Necessary Access
- Disclose Only the Minimum Necessary Information
- Safeguard Information in Transit
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Student Expectations

- Rules and Regulations
  - You will need to be logged in to WSU's SSO system to access data: on a WSU owned device, through WSU Security wifi, or via the WSU anywhere VPN
    - Never allow someone else to use your WSU login, or use someone else's login information
    - VPN:
    - https://www.wichita.edu/services/its/ITSApplicationsTraining/VPNWIndows.php
  - Use a strong password for your device and your WSU account, avoid reusing passwords, written passwords must be securely stored
  - Do not leave information unattended and accessible
    - Log out of devices if not in use, do not leave devices in public places
  - Do not open devices to security threats via public wifi, linking to another device, disabling security features and/or software

Student Expectations Cont

- Do not make unauthorized copies of your dataset
  - Don’t print, copy, photograph, or write down data
  - Do not save data to a portable device (external hard drive, USB drive, etc.)
  - Don’t upload data to any form of cloud storage
- Only Level 3 projects can store data locally (on computer hard drive)
  - Store all data in one folder, erase and overwrite folder at end of semester
- Do not publish or display data (final projects should not include dataset)
  - Do not show data via screen sharing or projection, be mindful of onlookers
- Only discuss data specifics with members of your group and class instructors
- Never email datasets, even to other group members

Data Disposal

- At the end of the semester, all data pertaining to these projects must be disposed of, local copies on KDSC devices will be deleted by KDSC staff
- If you are using your own device and have stored a local copy of any part of your dataset you must delete it and overwrite it
  - This is why all local copies must be stored together
  - Instructions on this process will be shared at the end of the semester
- Your access to the Virtual Server will be terminated at the end of the semester and KDSC staff will delete and overwrite data from the server

SYLLABUS

Objective of CS 896

- Provide hands on experiences for students to pre-process, analyze, and learn from provided datasets.
- Let students apply their knowledge on real world data
  - Real world project on your resume
- Teamwork experience
  - Groups of 2, no more than 3 people.

Grading Policy

- Late policy
  - No late assignments, presentations, and reports will be accepted.
- Extra credits
  - An extra 0.5 grade point will be given if a student is highly involved in research and produce publishable results.

First Week Attendance	5% (2.5% each)
Project Proposal Presentation:	15%
Mid Term Presentation:	20%
Progress Check-up Presentation	10% (5% each)
Final Project Report:	25%
Final Presentation:	25%

Academic Honesty

- Each student is expected to work independently on ALL home assignments, exams and quizzes.
- Any sharing/copying of solutions with any other person/website, whether intentional or unintentional, will be considered to be a violation of the rules and subject to a penalty to be determined by the instructor.

SCHEDULE

Need (Any) Advice?

- Office: 222 Jabara Hall
- Email: fujian.yan@wichita.edu
- Office hours: M 13:00 – 15:00 or by appointment
- MS Teams: We will have team ready later

What are your expectations?