# Collaborative Cloud-based Face Recognition Approach for Humanoid robots

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# Outline



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# Introduction



- The robots are increasingly present in human environments.
- The need to collaborate and exchange knowledge and information.
- The need of extensive computing capability and storage.
- Cloud robotic.
- One of the most important tasks for humanoid robots is face detection and recognition.

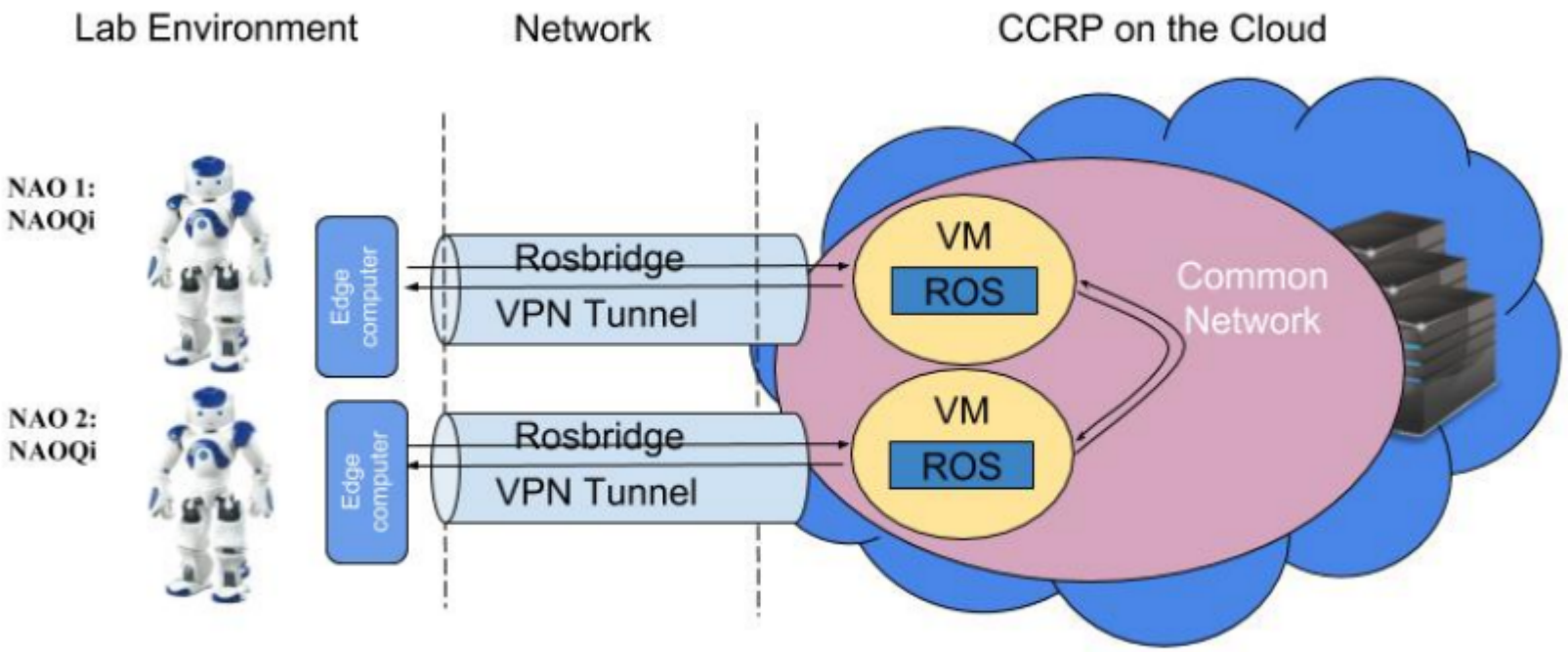
# Aim



- **The main focus of this work is to overcome these limitations and build a real-time FR cloud robotic application for NAO humanoid robots.**
- **Develop a collaborative face recognition cloud based application that allow Humanoid robot to detect and recognise human faces on the cloud.**
- **Share the new obtained knowledge with other authorized robots.**
- **Evaluate the performance of the CCRP in multi-robot environment.**

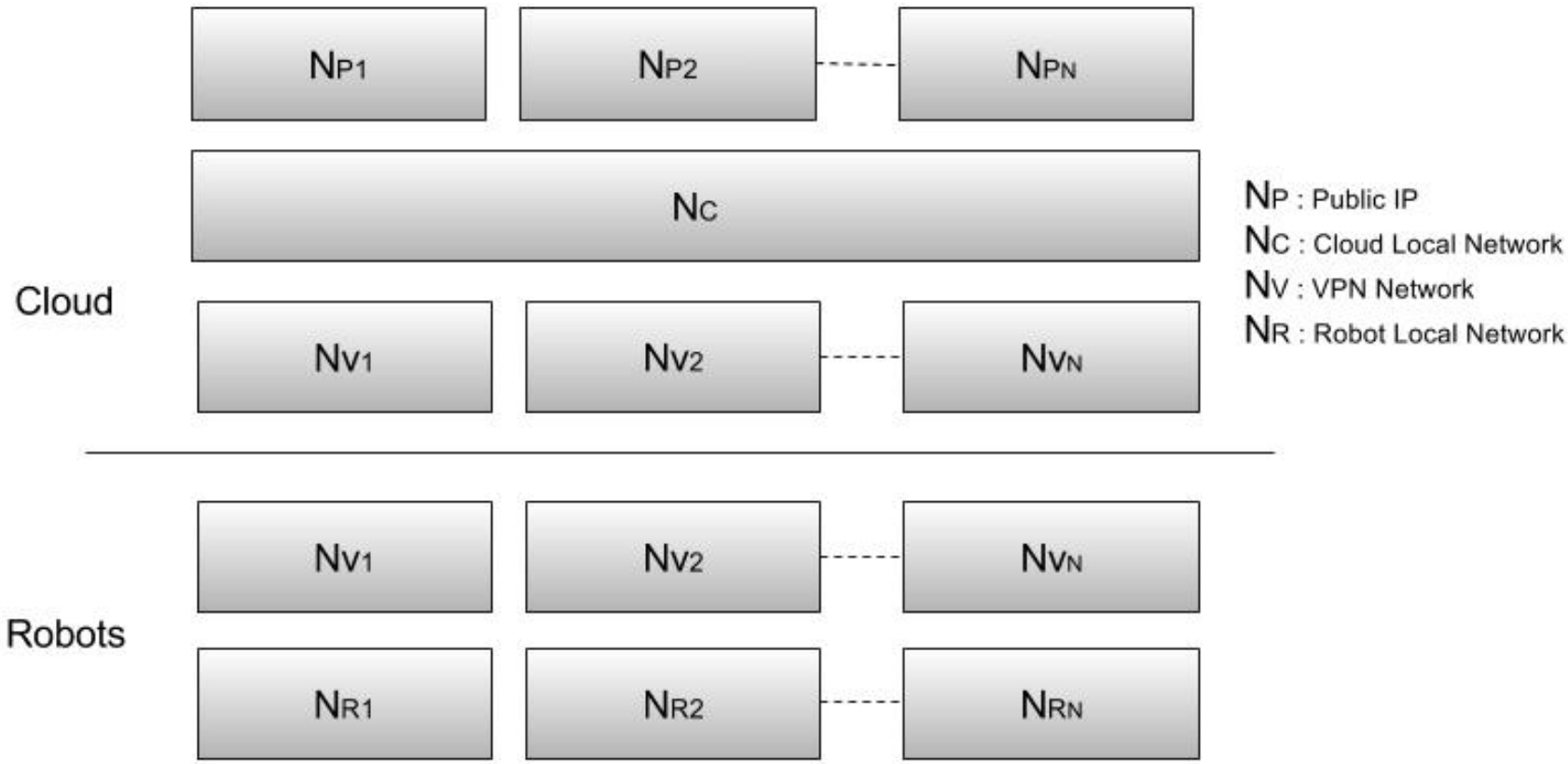
# CCRP SYSTEM ARCHITECTUR





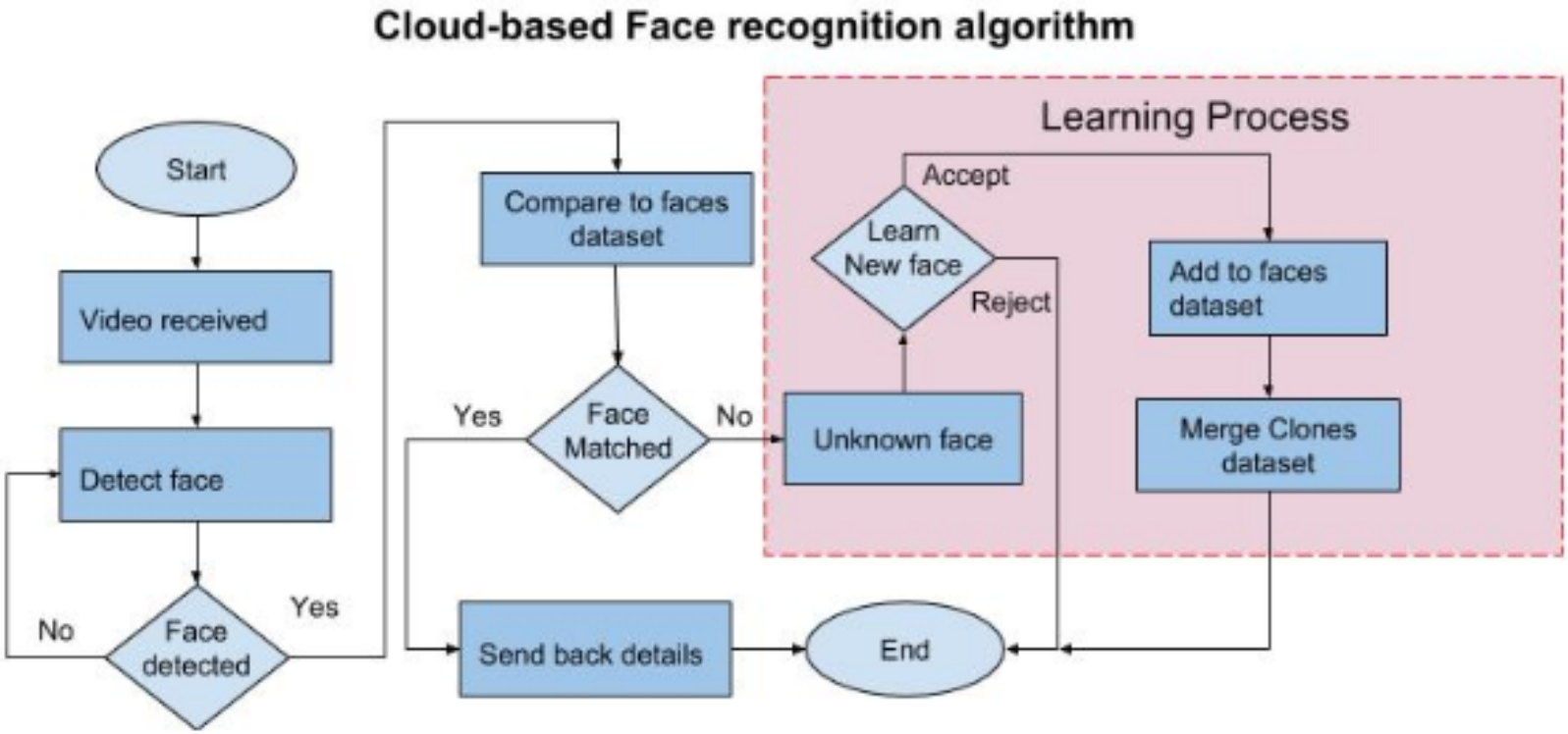
# Network Architecture





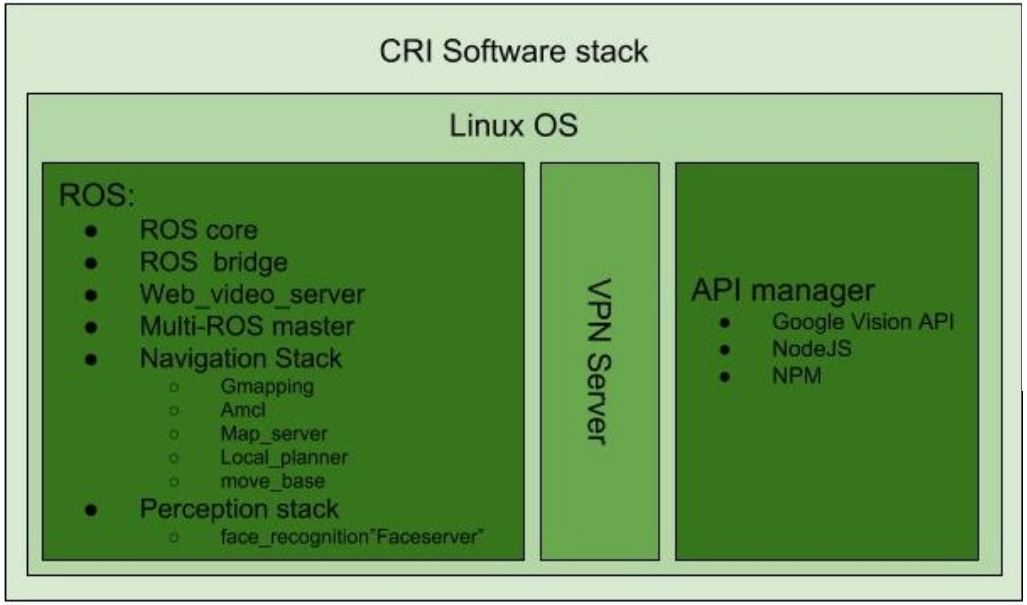
# Collaborative Cloud-based FR Algorithm

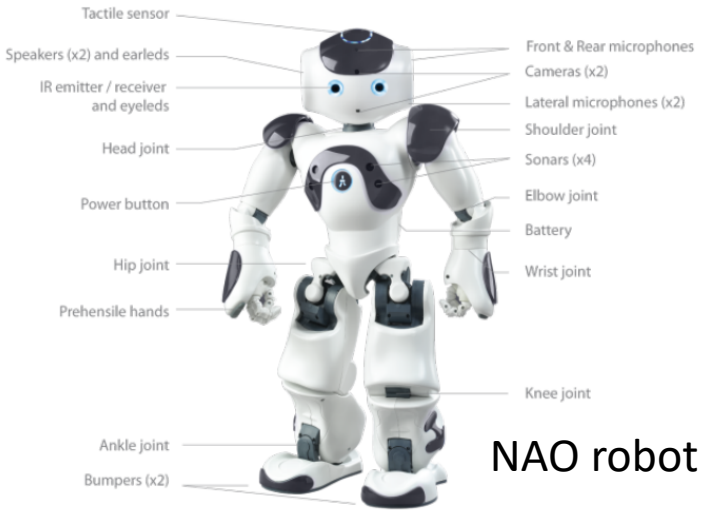




# EXPERIMENT REQUIREMENTS






NAO robot


OpenStack Private Cloud System

# EXPERIMENTAL RESULTS



TABLE I
THE RESULT OF THE LOCAL FR APPROACH SHOWS THE ACCURACY AND FAILURE RATE.

| No. of trained images | Confidence | Failure rate (%) |
|---|---|---|
| 1 | 0.21 | 55% |
| 5 | 0.33 | 35% |
| 10 | 0.69 | 15% |
| 20 | 0.76 | 0% |
| 30 | 0.82 | 0% |

TABLE II
THE RESULT OF THE CLOUD-BASED FR APPROACH SHOWS THE ACCURACY AND FAILURE RATE.

| No. of trained images | Confidence | Failure rate (%) |
|---|---|---|
| 1 | 0.18 | 65% |
| 5 | 0.32 | 40% |
| 10 | 0.63 | 15% |
| 20 | 0.77 | 5% |
| 30 | 0.83 | 0% |

# EXPERIMENTAL RESULTS



# Summary



- The research aimed to reduce the computational complexity in the robot system and to offload processing to the cloud VMs by utilizing clone-base cloud robotic platform (CCRP).
- We propose a new Collaborative Cloud-based Face Recognition Approach, which is implemented on the NAO humanoid robots, but can be deployed in other robots that support ROS and have the ability to capture images and video data.
- The CCRP proved its capability in running the face detection and recognition tasks effectively and it exceeded the performance of the local system with limited computational power and storage.
- knowledge sharing between the robots within the same ROS multi-master environment.
- Collaborative learning between the robots is becoming more important. It will optimize the robots' performance and use of resources by reducing common task repetitions.

# Thank you for Listening

# Any Questions