



# Computer Human Interaction via Intelligent Chess Robot

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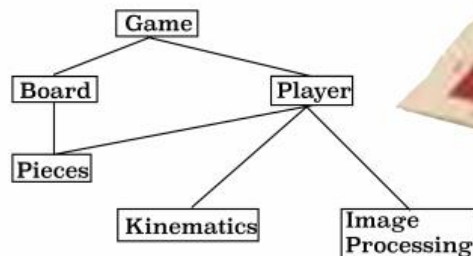
## Abstract

Robots that can judge a visual situation and react accordingly to a specific environment can aid in human-computer interaction. We implemented a tabletop chess robot that can observe its environment and act accordingly. This includes using methods to solve inverse kinematics for the arm, detecting board state from images, and determining good chess moves from a given board state. The end result is a robot that can reliably move and detect pieces on the board.

## Objectives

- Chess Engine follows rules of chess
- AI follows given strategy quickly
- Arms pick up and place pieces precisely
- Reliable board state detection from images

## Design



## Method Overview

### Kinematics

- Gradient Descent
- End Effector Modification
- Affine Transformations

### Image Processing

- Blob Detection
- Board State Estimator given blob locations

### Chess Engine

- Realistic Game Mechanics
- Move Inference from blob movements
- AI: Minimax with Alpha-Beta Pruning

## Arm Assembly

- 6 Degrees of Freedom
- 3D-Printed Links provided by APRIL Labs
- Dynamixel Servos
- 2 Arms to cover entire board

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