

# Augmented Reality Sudoku Solver

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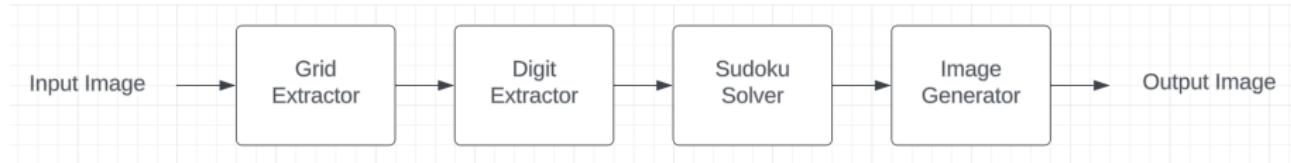
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# Introduction

**Aim:** Develop an AR system to solve Sudokus in images and video in real-time with

- *Low Resource Computation:* Efficient design for minimal resource utilization
- *Image & Real-time Video Support:* Robust and dynamic solving with image and live video feed integration with tracking
- *Robust Grid & Digit Extractor:* Accurate and versatile in various orientations, lightings, media (printouts, newspapers, computer screens), and support for handwritten digits
- *Multiple Grids Support:* Simultaneously processes different-sized and distant grids

# Methodology & System Design



- *Grid Extractor*: Extracts grids using image processing
- *Digit Extractor*: Extracts digits and uses a CNN model to classify them
- *Sudoku Solver*: Solves grids using an efficient implementation of Donald Knuth's Algorithm X with Dancing Links.
- *Image Generator*: Adds solved digits to the original image using image processing
- *Grid Tracker*: Tracks grids to reduce computation for real-time video

# Experiments and Results

## Lighting

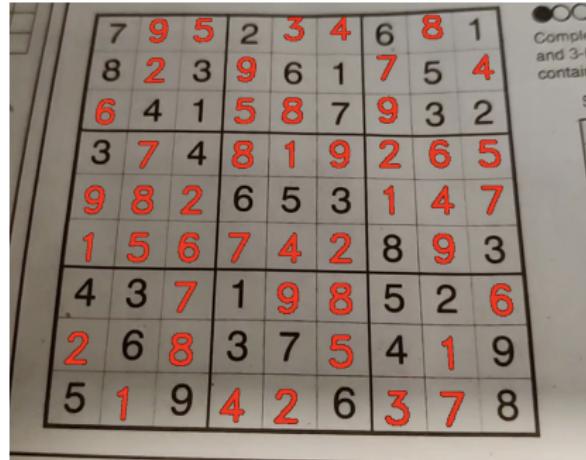
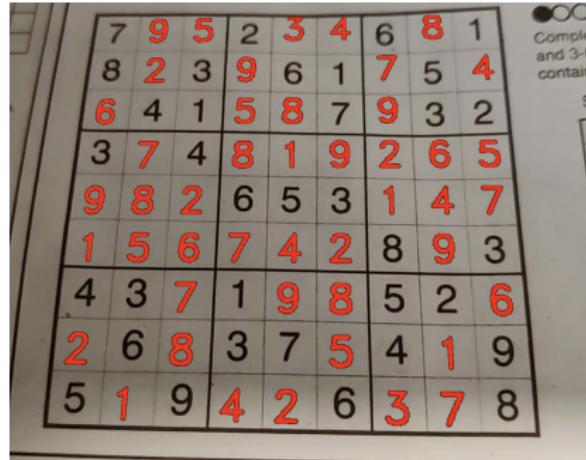
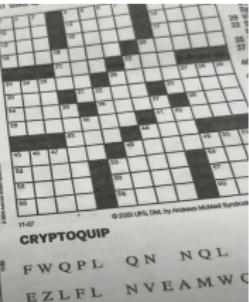
deal with this, but it leaves me to think about what they are capable of and they are capable of much behaviour. In particular, a young child is likely to be a young child with no sense of pride or answers?

— Not my child

**DEAR NOT MY CHILD:** It is possible that you have an abusive child. You are capable of controlling your temper and forgets that purity and disengagement toward your child is open to it, trying suggestions and coming up with a step out of unfortunate scenario. (The on would be if you are be verbal abuse could easily

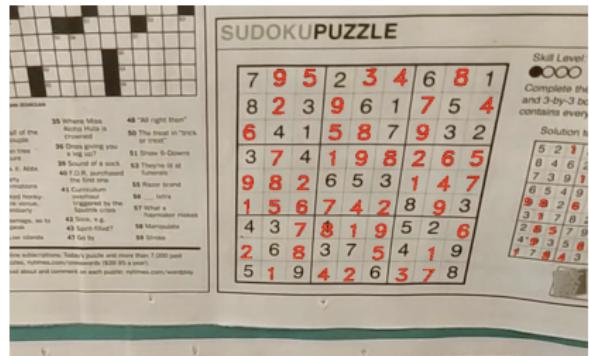
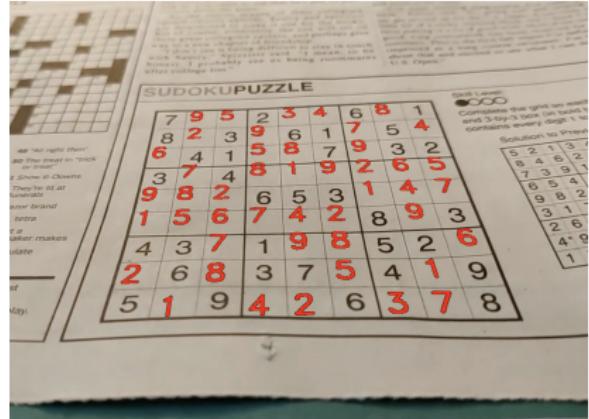
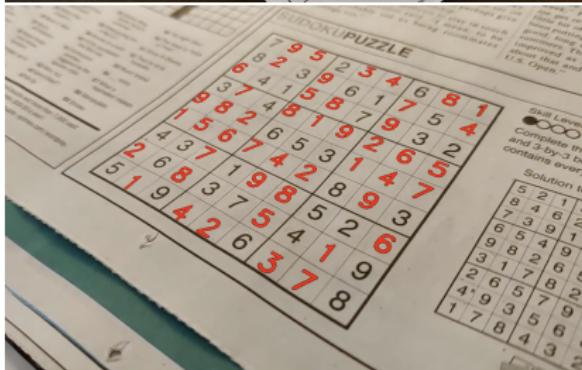
### no phone call?

ABBY: I am a single, aunt/great-aunt. For took on the task of visit family while the



# Experiments and Results

## Orientation



# Experiments and Results

## Handwritten Digits

4 John \_\_\_ of "Touched by an Angel"  
5 "CSI: Crime \_\_\_ Investigation"  
6 Cry of alarm  
7 Center of a tennis court  
10 "America's \_\_\_ Videos"  
11 Actor/producer/director Lee  
12 Monogram for Mary's portrayer  
on "Little House on the Prairie"  
13 Al Bundy's wife  
15 "Promised \_\_\_"  
17 "Peter \_\_\_", show that starred  
Mary Martin  
19 \_\_\_ Summer of "A Different  
World"  
20 "M\*A\*S\*H" actor  
22 King toppers  
23 Like meringue  
5 Benaderet and Arthur  
6 Hit hard  
7 Moran and Gray  
1 Light, crinkled fabric  
- & Order"  
Perch  
Elec. current unit  
Give the cold shoulder to  
Branch of mathematics, for short  
Expert  
kater Babilonia

DNS: Find as many words as you can by linking  
own, side-to-side and diagonally, writing words  
feet of paper. You may only use each letter box  
single word. Play with a friend and compare  
spelling out common words.

YOUR BOGGLE®  
SALE  
RATING  
• 1 point 151+ = Champ  
• 2 points 101-150 = Expert

DEATH DETECTIVE PASTOR SUPER

**SUDOKU**

1	6	3	4	5	7	9	2	8
4	2	5	9	8	1	6	7	3
9	7	8	6	2	3	1	4	5
6	4	7	5	1	9	8	3	2
5	3	2	7	6	8	4	9	1
8	9	1	2	3	4	5	6	7
7	8	9	1	4	2	3	5	6
2	1	6	3	9	5	7	8	4
3	5	4	8	7	6	2	1	9

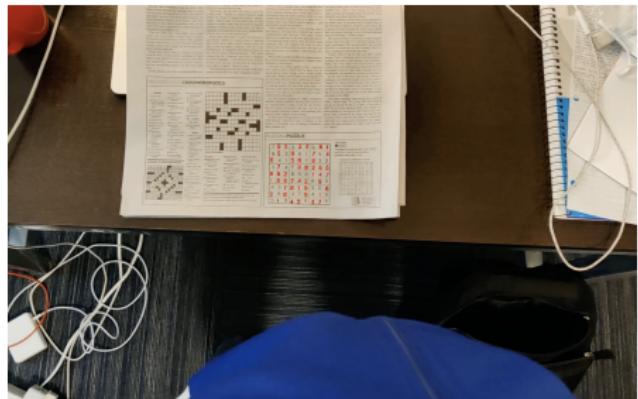
Level **1 2 3 4**  
Complete the grid so each row, column  
and 3-by-3 box (in bold borders) contains  
every digit from 1 to 9. For strategies  
on solving Sudoku, visit [sudoku.org.uk](http://sudoku.org.uk).

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FIND 3 DIFFERENCE

# Experiments and Results

## Far Away Grids



# Experiments and Results

## Multi-Size Grids

