TECH SQUAD

NATIONAL SECURITY INNOVATION NETWORK

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**DoD SPONSOR:**

## Air Force Futures, AI Cross-Functional Team

**DESIRED SOLUTION:**

## Computer Vision Algorithm

**PROBLEM STATEMENT:**

The Air Force AI Cross-Functional Team has been tasked with setting the stage and driving the capability development and governance of artificial intelligence across the Air and Space Forces. We want computer vision algorithm(s) to save Airmen and Guardians valuable time doing tedious, repetitive tasks. This project involves developing an AI algorithm that can read a training certificate and validate that it is correct. Every service member is required to complete various training courses throughout their career and show proof of completion to someone within their organization each time. Being able to automatically scan and validate training certificates would save thousands of hours per year for the Air Force.

**DESIRED SOLUTION:**

The desired end-state for this problem is an algorithm that accepts a training certificate as an input and outputs the type of certificate and the name on the certificate.

**SKILLS:**

- AI/ML
- Computer
- Vision

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# AIR FORCE FUTURES (AI CFT)

CHARLIE LU

AUGUST 25, 2021

# BACKGROUND

- Air Force AI CFT develops capability and governance of artificial intelligence across Air and Space Forces
- AI algorithms can save valuable time by automating tedious and repetitive task
- Every service member required to complete training courses
- Being able to automatically validate training certificates would save thousands of hours per year for the Air Force

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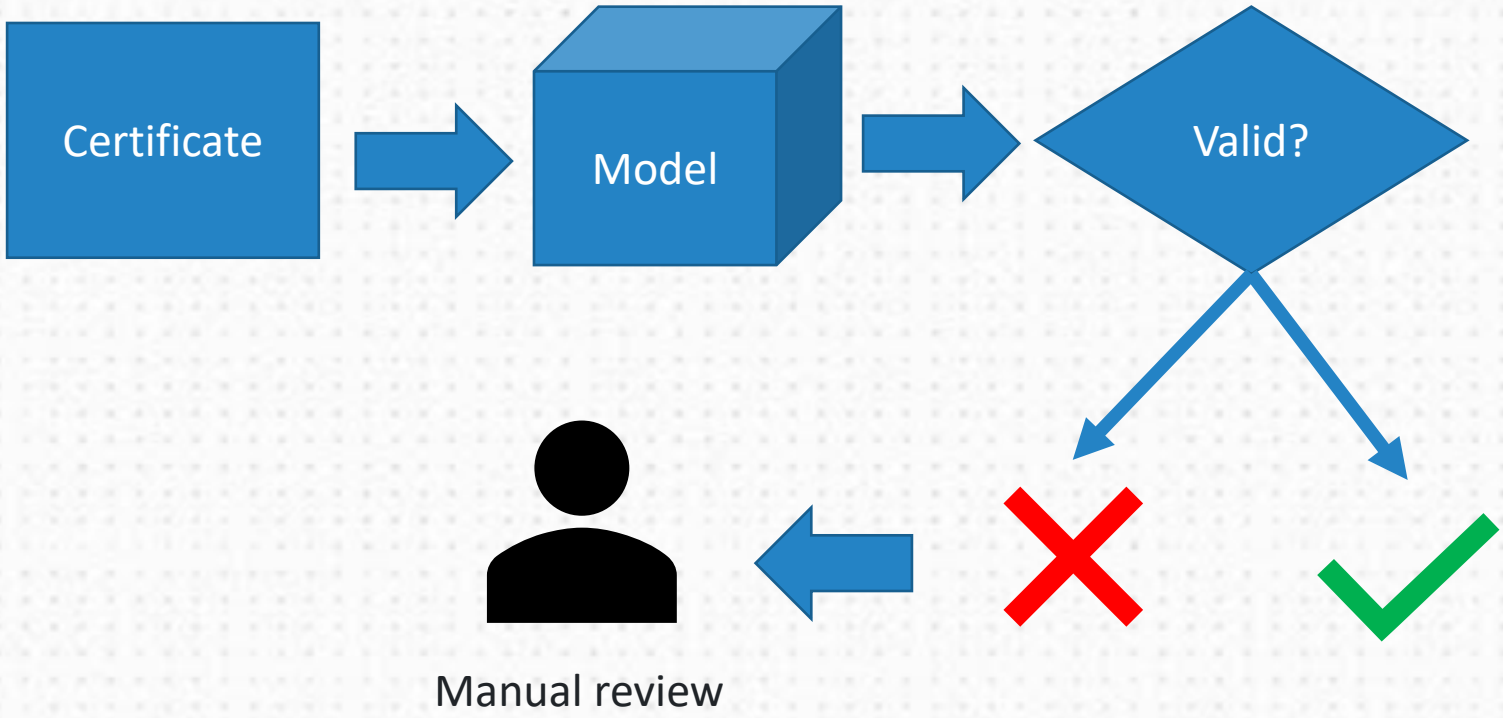
# WORKFLOW

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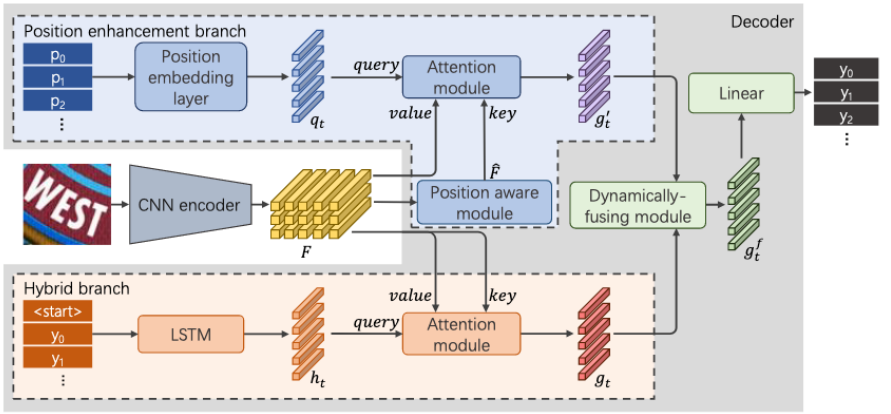
# COMPUTER VISION MODEL

- Deep learning based model for OCR
  - RobustScanner architecture for text recognition [1]
  - Implemented open source MMOCR library [2]





1. https://arxiv.org/pdf/2007.07542.pdf
2. https://github.com/open-mmlab/mmocr

# FUZZY TEXT MATCHING

- Extracted text is not always perfect
  - "Michael" may be extracted as "MIchael", "MiclhaeI", or "ichael"
- Use dynamic programming algorithm [1] to still match text with slight errors

$$\operatorname{lev}(a,b) = \begin{cases} |a| & \text{if } |b| = 0, \\ |b| & \text{if } |a| = 0, \\ \operatorname{lev}(\operatorname{tail}(a), \operatorname{tail}(b)) & \text{if } a[0] = b[0] \\ 1 + \min \begin{cases} \operatorname{lev}(\operatorname{tail}(a), b) \\ \operatorname{lev}(a, \operatorname{tail}(b)) \\ \operatorname{lev}(\operatorname{tail}(a), \operatorname{tail}(b)) \end{cases} & \text{otherwise.} \end{cases}$$

| | | S | a | t | u | r | d | a | y |
|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| S | 1 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| u | 2 | 1 | 1 | 2 | 2 | 3 | 4 | 5 | 6 |
| n | 3 | 2 | 2 | 2 | 3 | 3 | 4 | 5 | 6 |
| d | 4 | 3 | 3 | 3 | 3 | 4 | 3 | 4 | 5 |
| a | 5 | 4 | 3 | 4 | 4 | 4 | 4 | 3 | 4 |
| y | 6 | 5 | 4 | 4 | 5 | 5 | 5 | 4 | 3 |

1. https://en.wikipedia.org/wiki/Levenshtein_distance

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# INPUT


CERTIFICATE of ACHIEVEMENT
This is to certify that
Mark Clements
has completed
Derivative Classification
July 29, 2019
KEVIN J. JONES
Director, CDSE
Verification Code
Ypb9ywelGd
DEFENSE SECURITY SERVICE
UNITED STATES OF AMERICA

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# DETECTED TEXT


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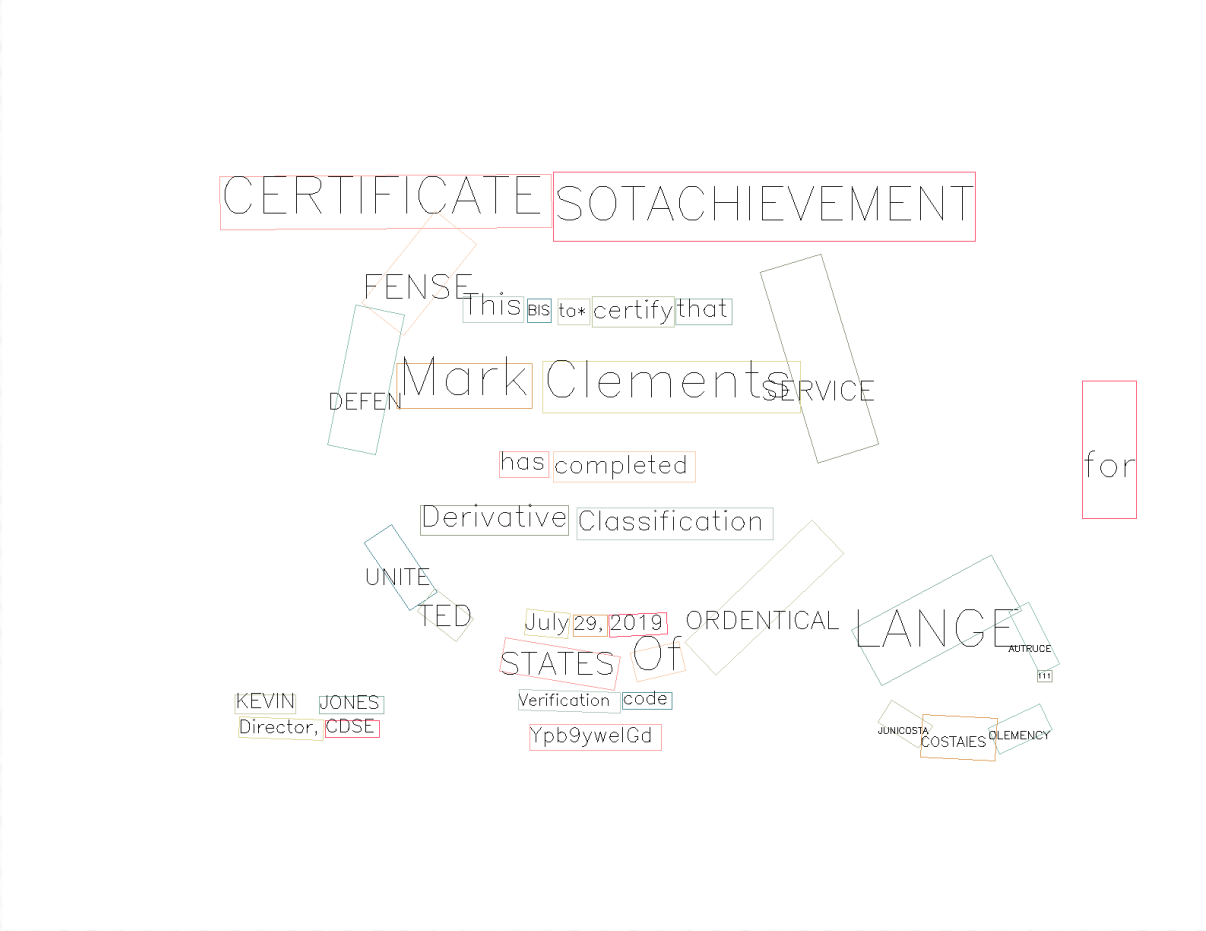
# EXTRACTED TEXT

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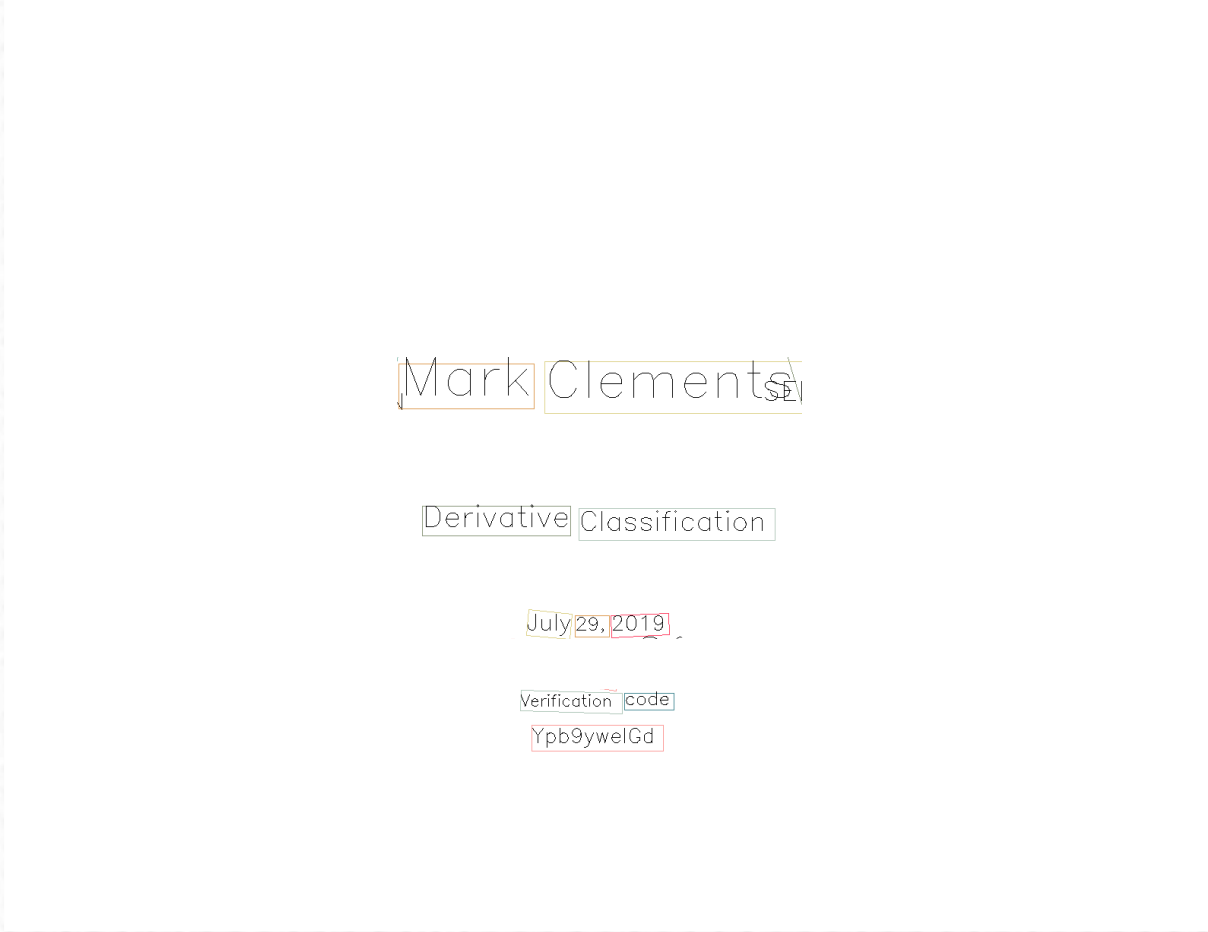
# POST-PROCESSED

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# FINAL OUTPUT

NAME:  MARK CLEMENTS
CERTIFICATE:  DERIVATIVE CLASSIFCATION
DATE ISSUED:  JULY 29, 2019
VERIFICATION CODE:  Ypb9ywelGd

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# FUTURE WORK

- Measuring accuracy and efficiency
  - A/B User test
- Robustness and generalizability
  - Real world stress testing
  - Error analysis of outliers
- Integration
  - Define software requirements
  - Design user interface

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# Summary

- Developed AI prototype to extract important text from images of training certificates
- Model can be deployed to automatically validating certificates
- Potential to save thousands of hours of manual work for the Air Force

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# CHARLIE LU

**Military Sponsor:**
**Nick Forrest, 1st Lt, USAF**
**Artificial Intelligence CFT**
**AF/A5/7, Air Force Futures**
**Pentagon, Washington, D.C.**

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