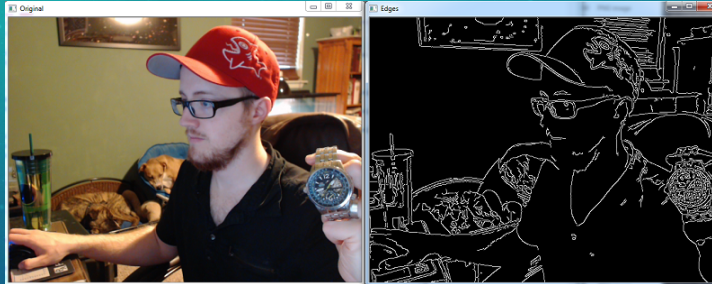


Applications of Digital Image Processing in Defense



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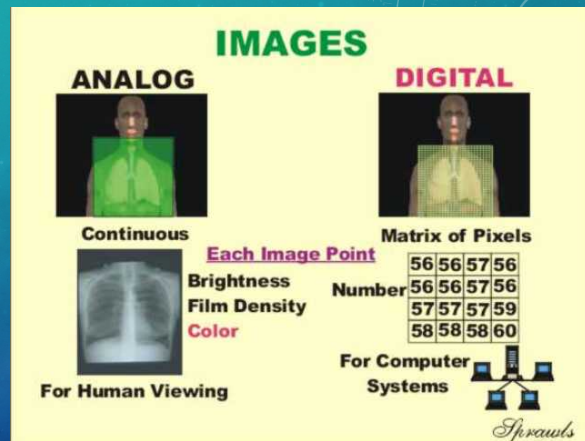
OUTLINE

- Background
- Purpose
- Introduction
- Steganography
- SyNAPSE
- Autonomous Vehicles
- Remote Sensing
- Conclusion

2

BACKGROUND

- Image processing is the means of how an input image is manipulated.
- There are 2 types of image processing, analog and digital.



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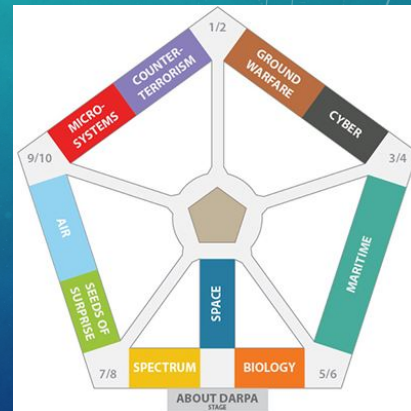
PURPOSE

- Image processing helps us in mainly in 5 ways:
 - 1) Visualisation
 - 2) Image restoration and sharpening
 - 3) Image retrieval
 - 4) Measurement of pattern
 - 5) Image recognition

4

INTRODUCTION

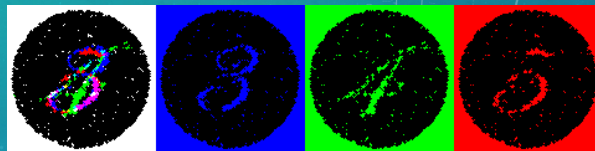
- Various applications of image processing in defense such as:
- Steganography
- SyNAPSE (Systems of Neuromorphic Adaptive Plastic Scalable Electronics)
- Autonomous Vehicle
- Remote sensing



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STEGANOGRAPHY

- Steganography is the act of concealing messages within some form of data.
- Sites to try steganography:
 - <http://www.petitcolas.net/steganography/mp3stego/>
 - <http://www.jitc.com/Steganography/toolmatrix.htm>
 - <http://www.heinz-repp.onlinehome.de/Hide4PGP.htm>

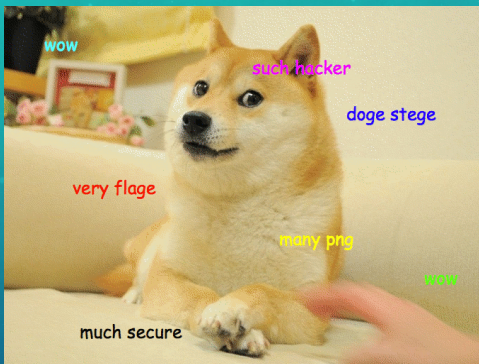


Original Hidden Image

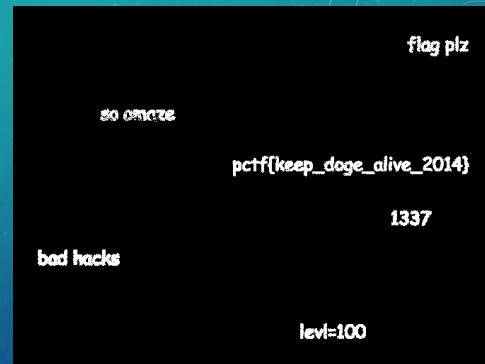
Hidden Image

6

STEGANOGRAPHY



Original hidden image



Hidden text

7

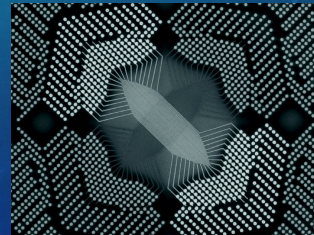
STEGANOGRAPHY

- An example of a message containing cipher text by German Spy in World War II:
"Apparently neutral's protest is thoroughly discounted And ignored. Isman hard hit. Blockade issue affects Pretext for embargo on by products, ejecting suets and Vegetable oils."
- Taking the second letter in each word the following message emerges:
Pershing sails from NY June 1.

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SYNAPSE(SYSTEMS OF NEUROMORPHIC ADAPTIVE PLASTIC SCALABLE ELECTRONICS)

- Defense Advanced Research Projects Agency (DARPA) created a program in 2008 called SyNAPSE.
- The main contractors of this project are IBM and HRL.
- UoM professor has found a way to process images and videos 1000 times faster.
- Idea is to recognise that most of the image data or video is essentially noise.



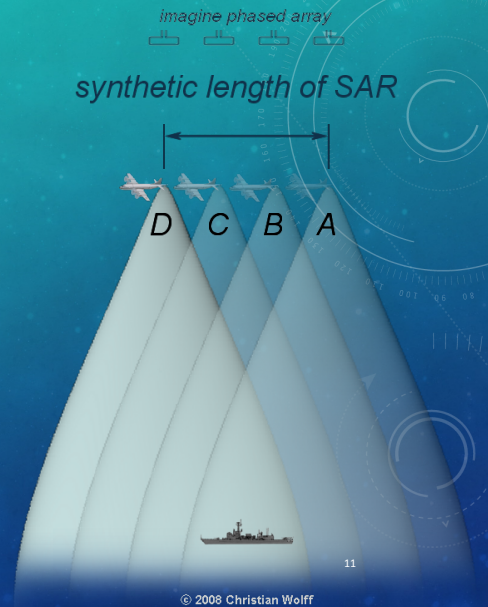
AUTONOMOUS VEHICLE

- Defense Advanced Research Projects Agency (DARPA) hosts regular competitions among universities to decide which can build a good autonomous vehicle.
- Autonomous vehicles are essential part of defense.



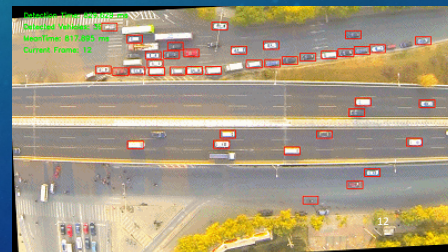
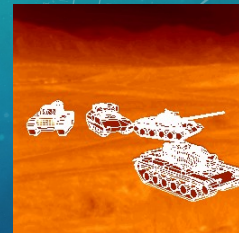
REMOTE SENSING

- Remote sensing mainly includes detecting tanks, mines, etc.
- A very huge industry with companies such as DARPA, Martin-Lockheed, TSR, Northrup-Grumman, other aerospace contractors researching in this area.
- Imagery techniques:
 - 1) Synthetic Aperture Radar (SAR)
 - 2) Inverse Synthetic Aperture Radar (ISAR)
 - 3) Advanced Scanning Technology for Imaging Radars (ASTIR)
 - 4) Sonar
 - 5) Hyper-Spectral Imagery(more than 3 colors)



REMOTE SENSING

- Automatic Target Recognition (ATR) is also a radar based recognition system.
- ATR first has to extract the features from the image using linear predictive coding and time frequency analysis algorithm(Short time fourier transform)
- After the spectral information is extracted the information is compared to a database to see what to make of the illuminated targets.



CONCLUSION

- Digital Image processing has changed the field of defense.
- With the rise in AI, Image processing will surely play a vital role with it.