



DIGITAL IMAGE PROCESSING



**X-RAY IMAGE ENHANCEMENT
ALGORITHM FOR DANGEROUS
GOODS**

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► PROBLEM STATEMENT AND MOTIVATION

- **Problem:**
 - **X-ray images often suffer from low contrast, color distortion, and noise, making it challenging to identify dangerous goods accurately.**
- **Motivation:**
 - - Improve airport security by enhancing X-ray image clarity.
 - - Reduce manual errors and improve detection speed for dangerous items.
 - - Ensure safe and efficient operations at airports.



PROPOSED SOLUTION

- We propose an image enhancement algorithm combining:
- Contrast Limited Adaptive Histogram Equalization (CLAHE)
- Unsharp Masking (USM)
- This approach enhances contrast, suppresses noise, and sharpens edges, making it easier to identify objects in X-ray images.





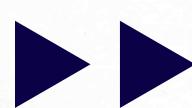
IMPORTANCE OF CLAHE

- Enhances contrast in localized regions of the image.
- Prevents over-amplification of noise using a contrast limit.
- Reduces color distortions by working on grayscale channels.
- Application: Highlights subtle differences in X-ray images to improve object visibility.



IMPORTANCE OF USM (UNSHARP MASKING)

- **Enhances edges and improves visual perception of objects.**
- **Suppresses false edges by applying thresholds.**
- **Brings out details and shapes, aiding in object detection.**
- **Application: Highlights boundaries of objects like weapons or wires in X-ray images.**



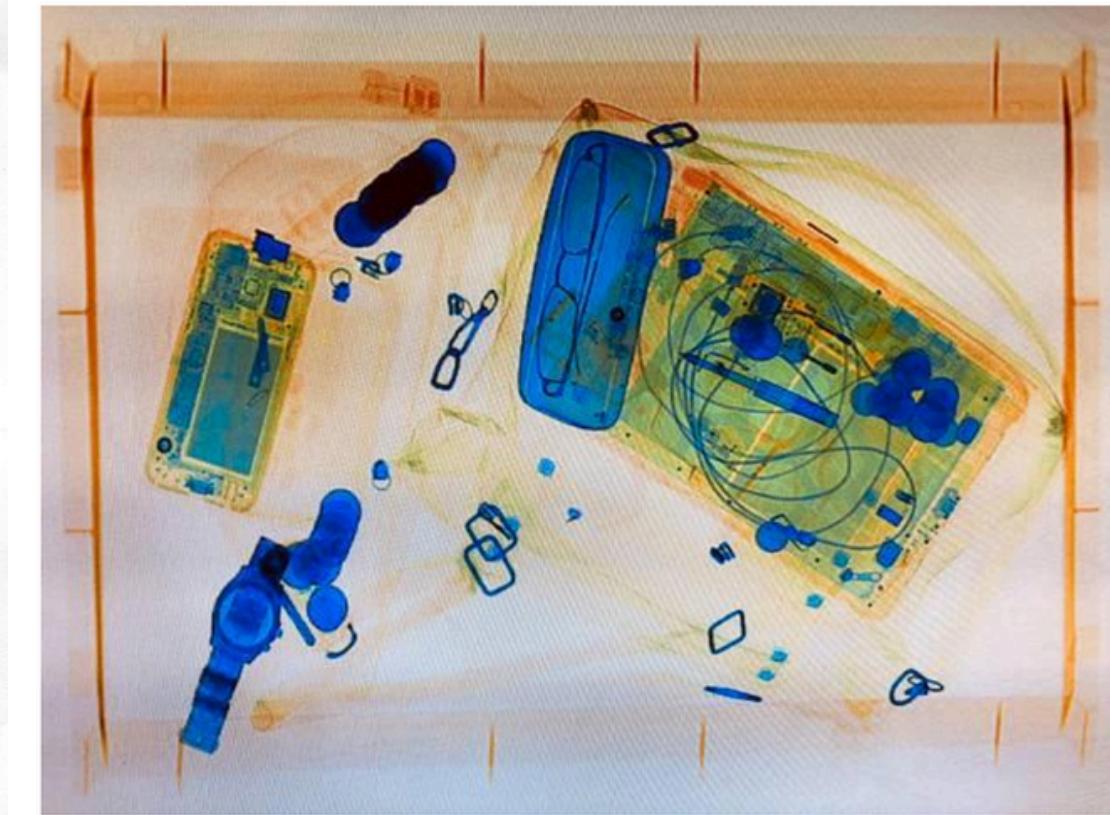
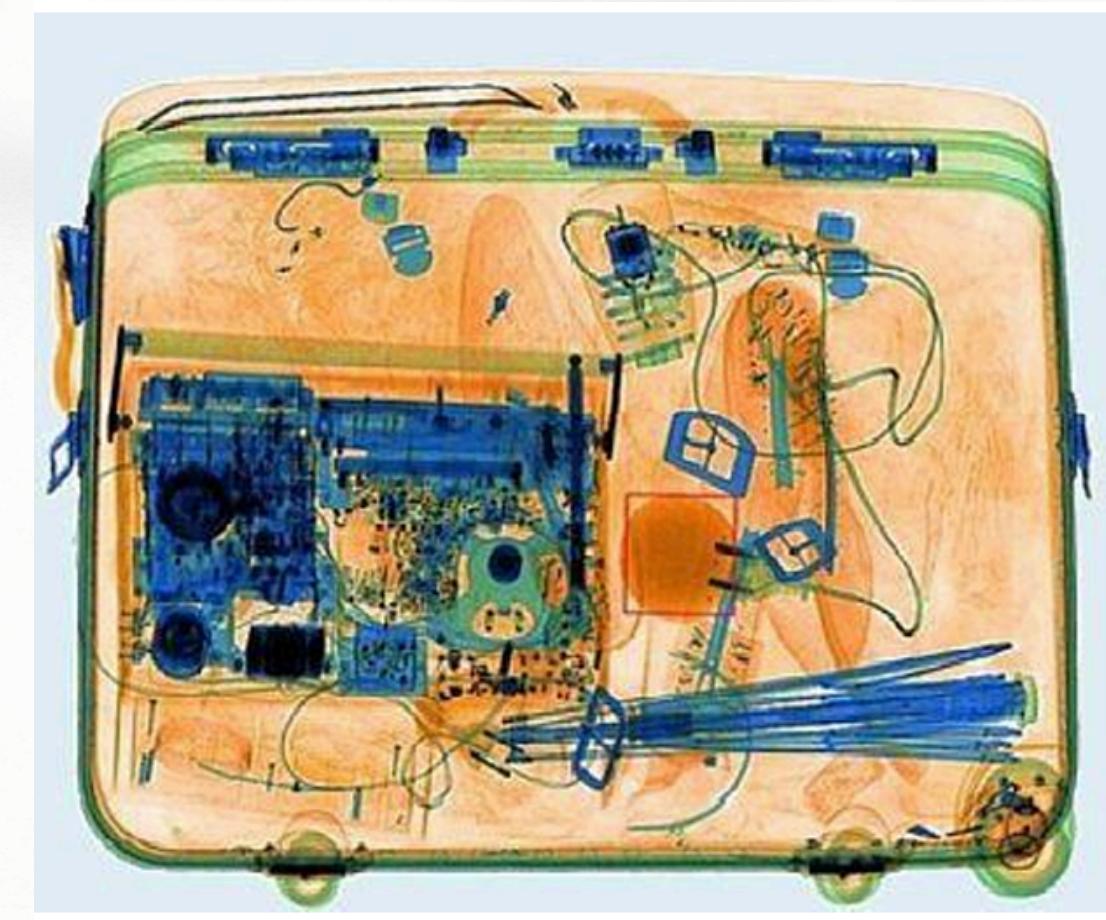


ADVANTAGES OF USM + CLAHE

- Complements each other: CLAHE enhances contrast, USM sharpens details.
- Reduces noise amplification and false edges.
- Improves detection accuracy of dangerous goods.
- Simple and computationally efficient for real-time applications.



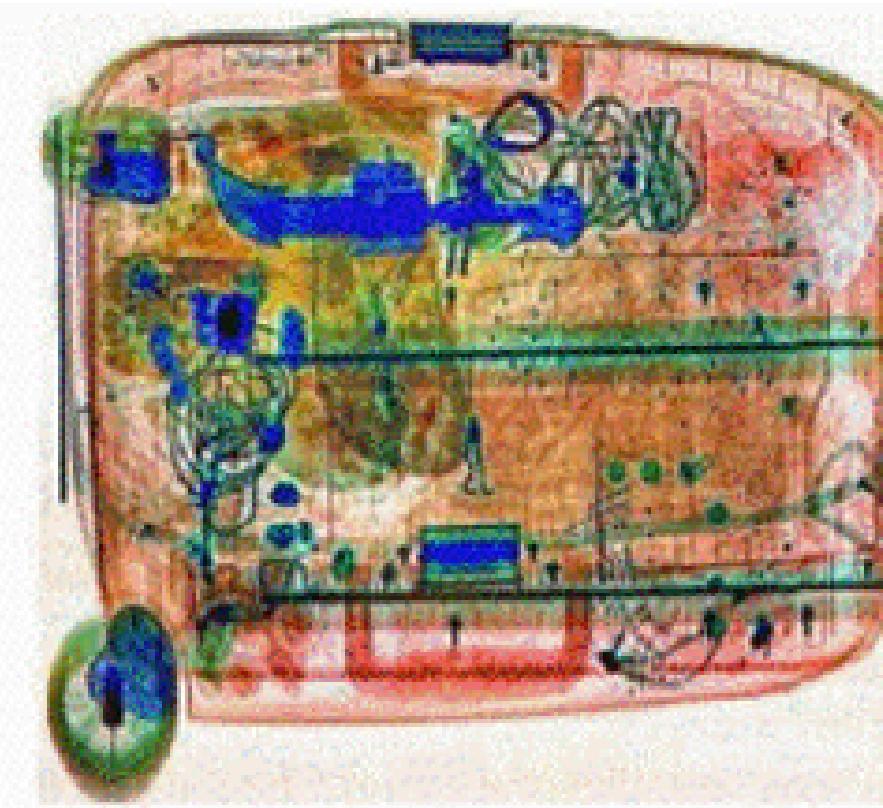
➤ FINAL OUTPUT IMAGES



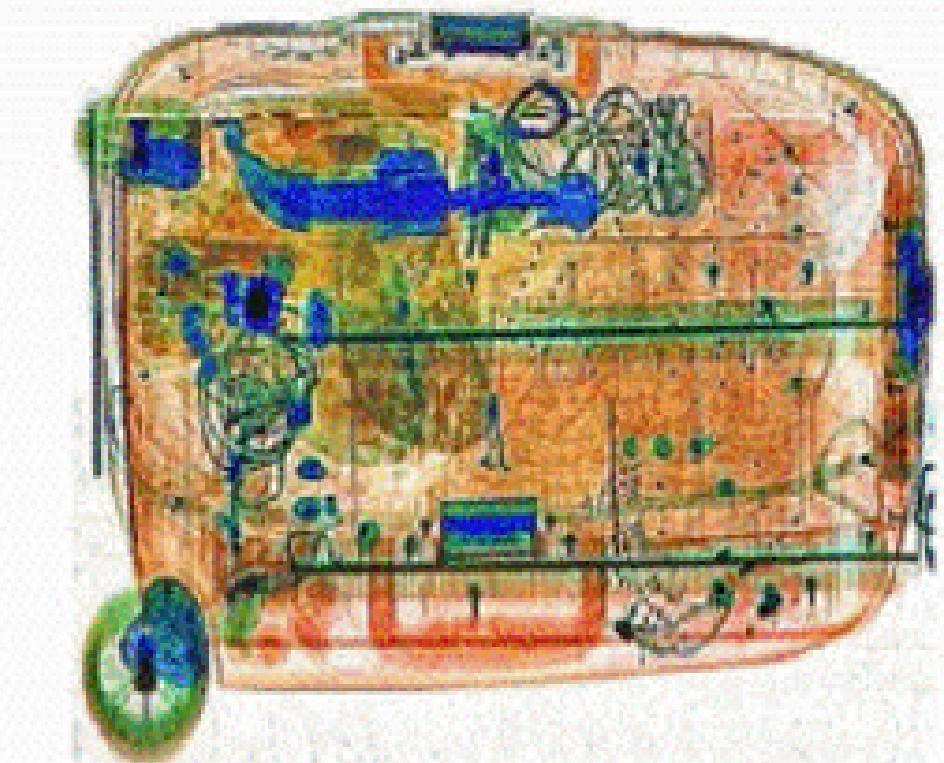
COMPARISON OF IMAGES:



(1)



(2)



(3)

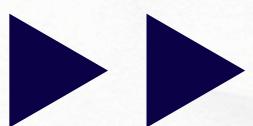
1. ORIGINAL IMAGE

2. ENHANCEMENT IMAGE RESULT OF CLACHE

3. ENHANCEMENT IMAGE RESULT OF PROPOSED

➤ CONCLUSION

- The **USM+CLAHE algorithm effectively enhances X-ray images by improving contrast and edge details.**
- Reduces color distortions and highlights important features.



Thank
You!

