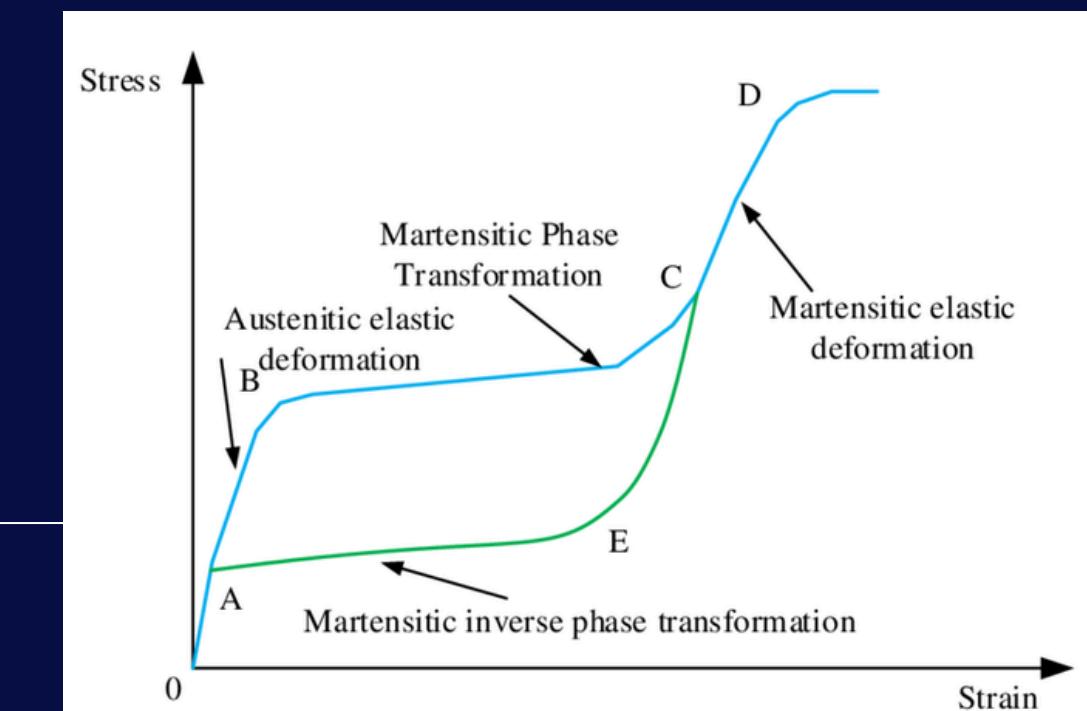


AUTOMATED RESEARCH ARTICLE ANALYSIS SYSTEM FOR SHAPE MEMORY ALLOYS



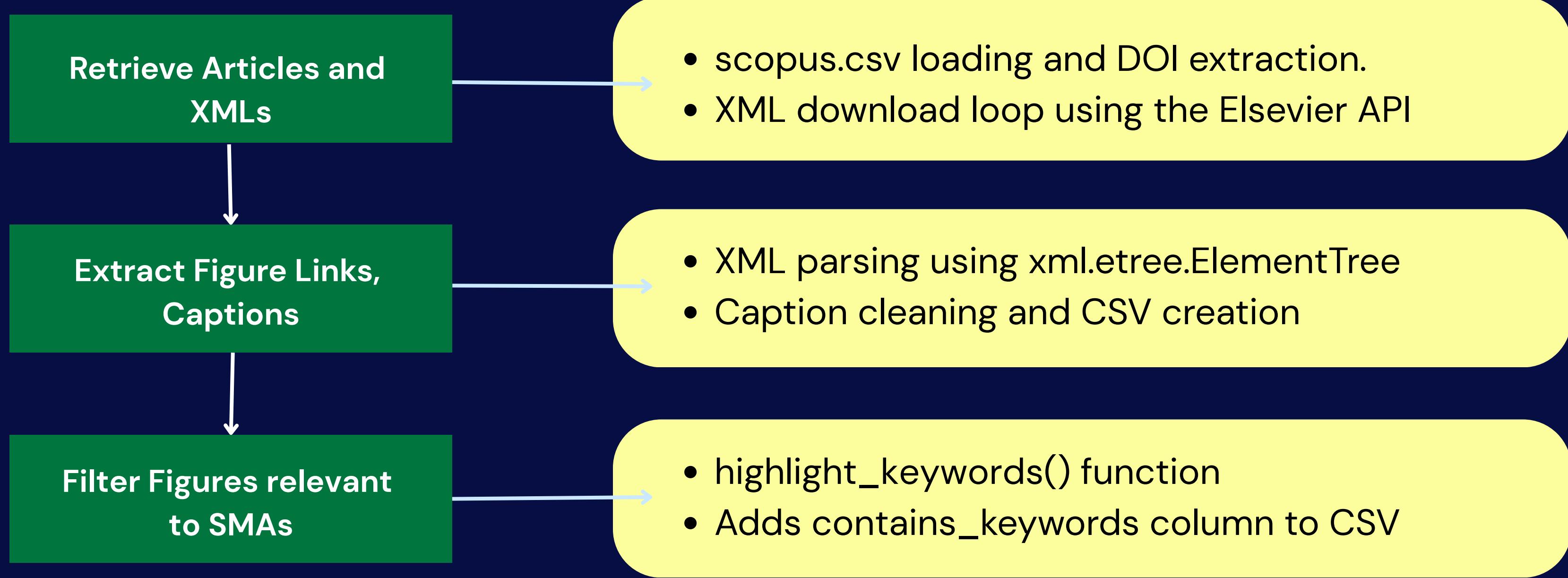
OBJECTIVE

- Using Deep Learning Model (YOLO-based Model) and advanced text and image extraction (including Optical Character Recognition) to classify articles based on keywords and relevant graphs.
- To accelerate the discovery and synthesis of Shape Memory Alloys by pinpointing key processsing parameters and properties through automated literature analysis.

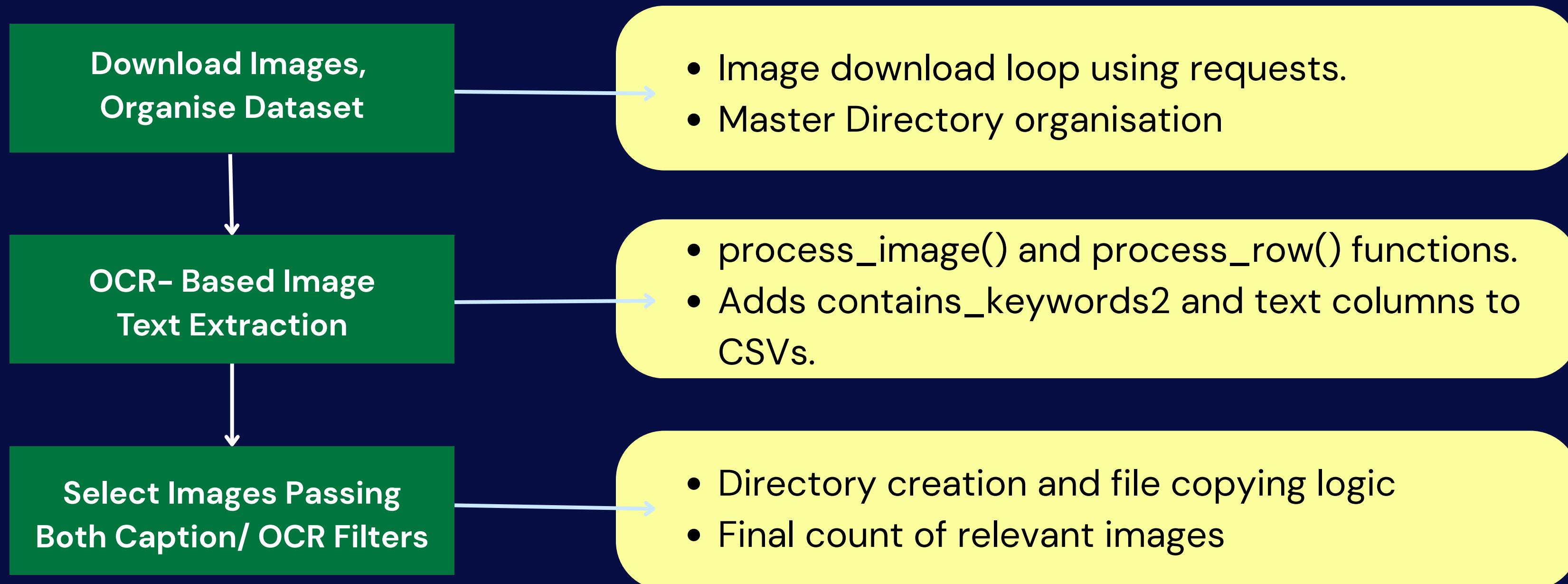
INTRODUCTION

- Scientific literature in materials science contains vast amounts of valuable data on smart and responsive materials, especially SMAs.
- Shape Memory Alloys: Materials capable of recovering their original shape after deformation when heated to a critical temperature due to the martensitic transformation and shape memory effect.
- Traditional identification of SMAs involves painstaking experimental trials and manual review of thousands of articles—a labour-intensive, time-consuming process.
- Need for robust, automated, literature-based discovery (LBD) methods to mine actionable knowledge and speed up research progress.

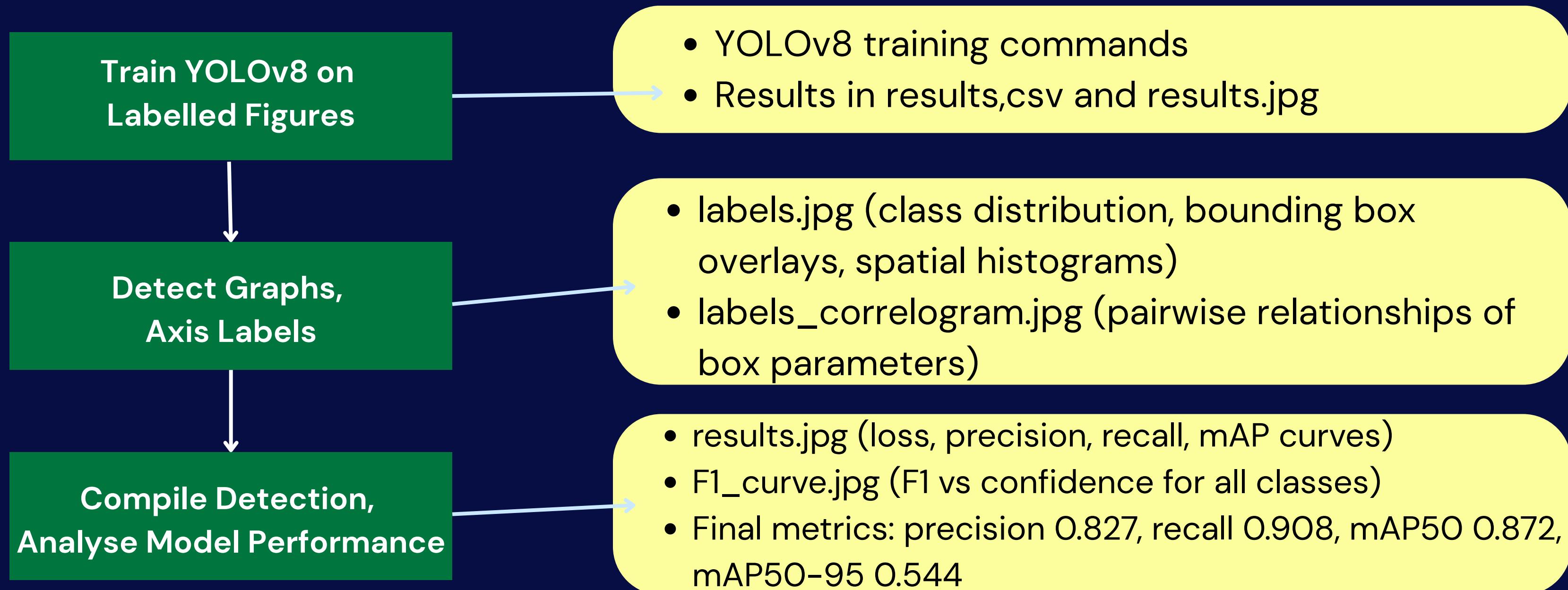
METHODOLOGY



METHODOLOGY



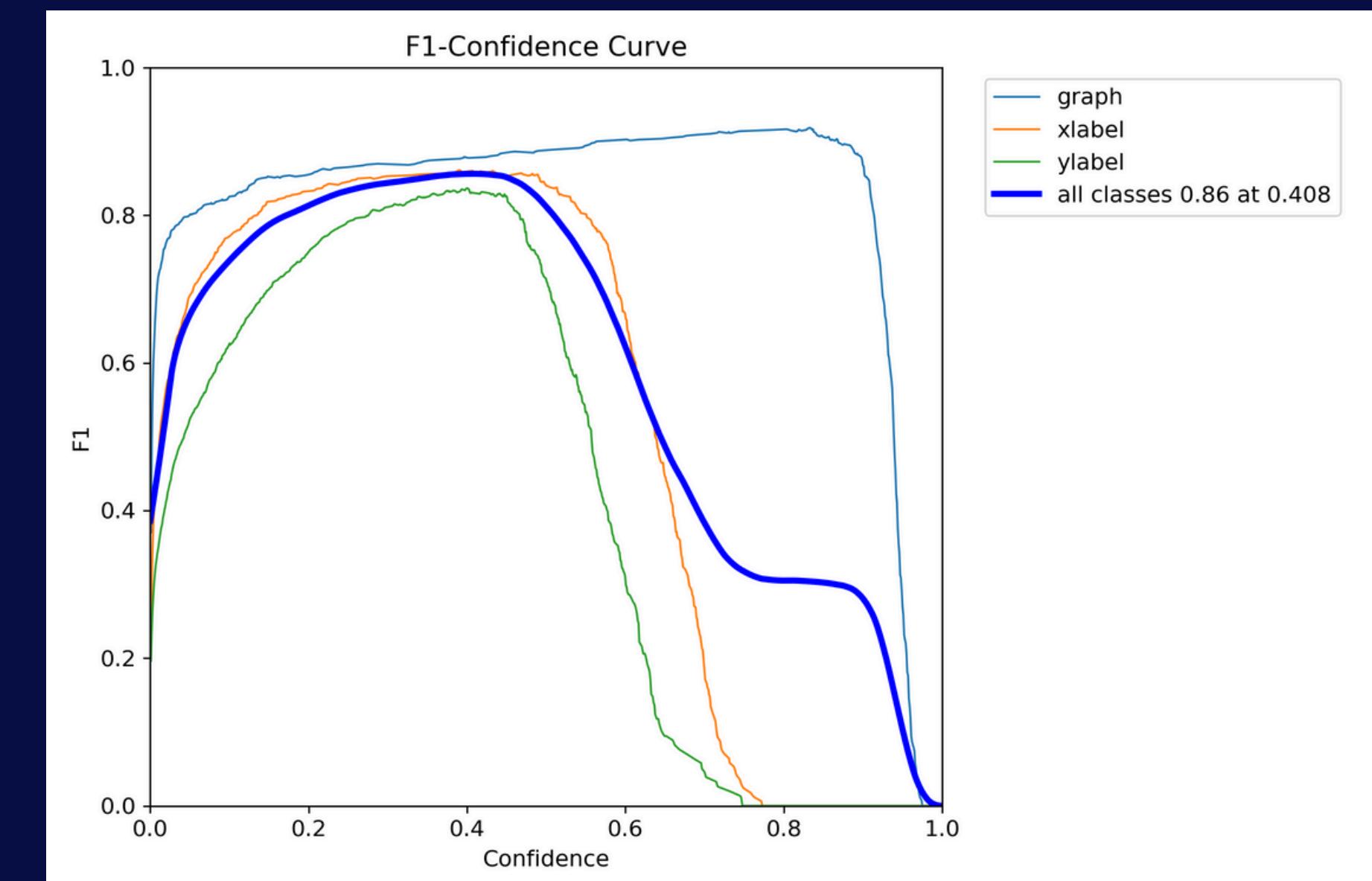
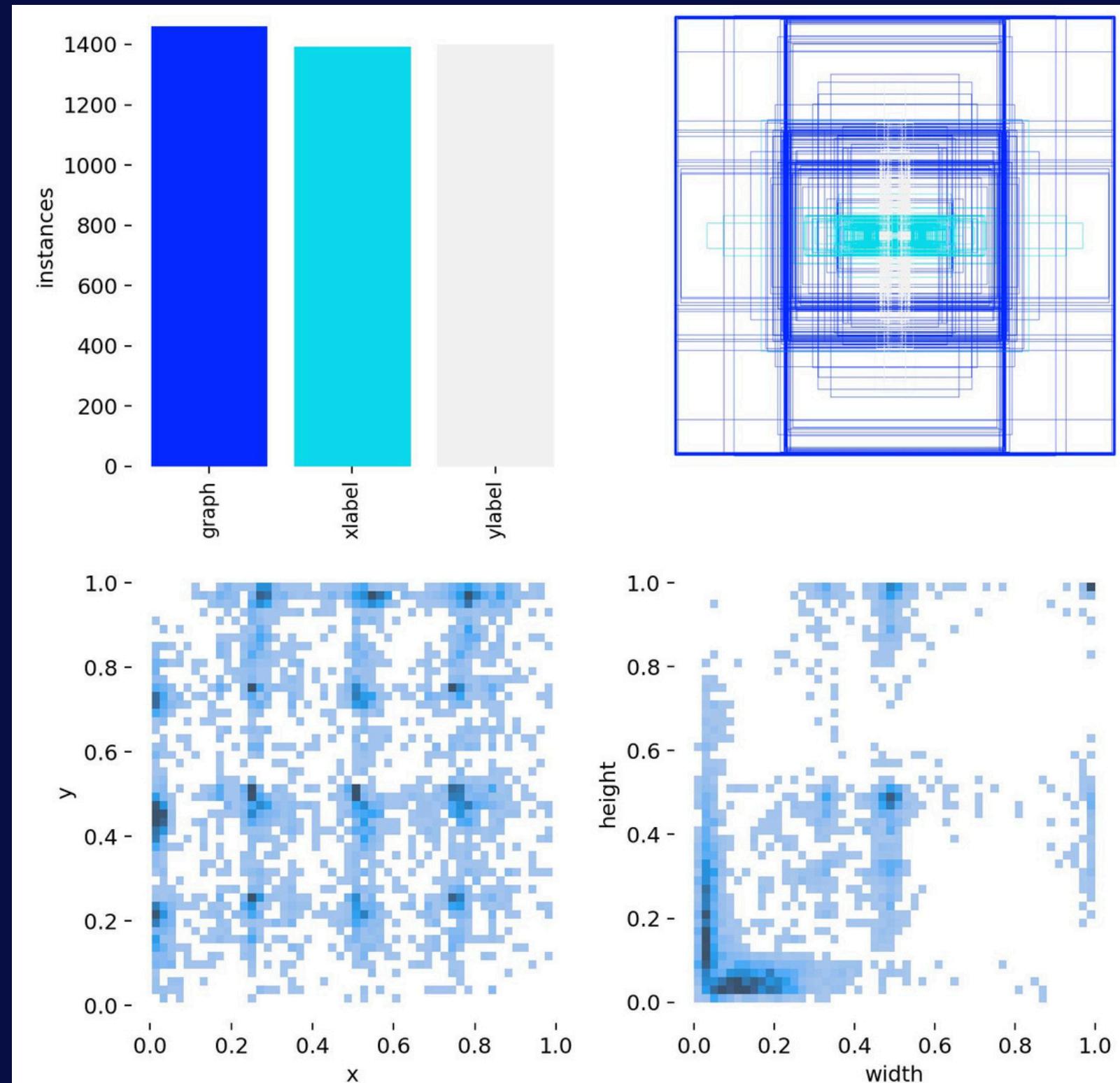
METHODOLOGY



RESULT

- From 5,000+ articles, 580 high-relevance articles containing SMA stress-strain graphs were identified.
- The automated system successfully detected:
 1. 1,450 graph instances from literature
 2. X-labels and Y-labels at similar rates (~1,400 each), with spatial distribution analysis confirming correct identification of conventional plot layouts.
- YOLOv8 model achieved an F1 score of 0.86 for trained classification.
- Multi-stage filtering identified 17 high-confidence graphs out of 38 possibilities (approx. 45% precision, zero false positives).
- Statistics and extracted parameters help in determining whether a material qualifies as an SMA, supporting faster advancement in the field.

RESULT



CONCLUSION

- The developed automated extraction system dramatically accelerates the process of identifying and analyzing critical SMA properties from vast scientific literature.
- Integration of figure-keyword extraction, image classification, and article field classification enables high-precision, scalable knowledge discovery.
- The results support rapid breakthroughs in Shape Memory Alloy research by efficiently pin-pointing key processing parameters and properties, eradicating dependence on manual labor for literature review.
- The approach paves the way for future advances in automated scientific data mining, with strong implications for speeding up materials science innovation.