2021 NSF CYBER-PHYSICAL SYSTEMS PRINCIPAL INVESTIGATORS' MEETING

Srch3D: Efficient 3D Model Search via Online Manufacturing-specific Object Recognition and Automated Deep Learning-Based Design Classification (Award # 1932146)

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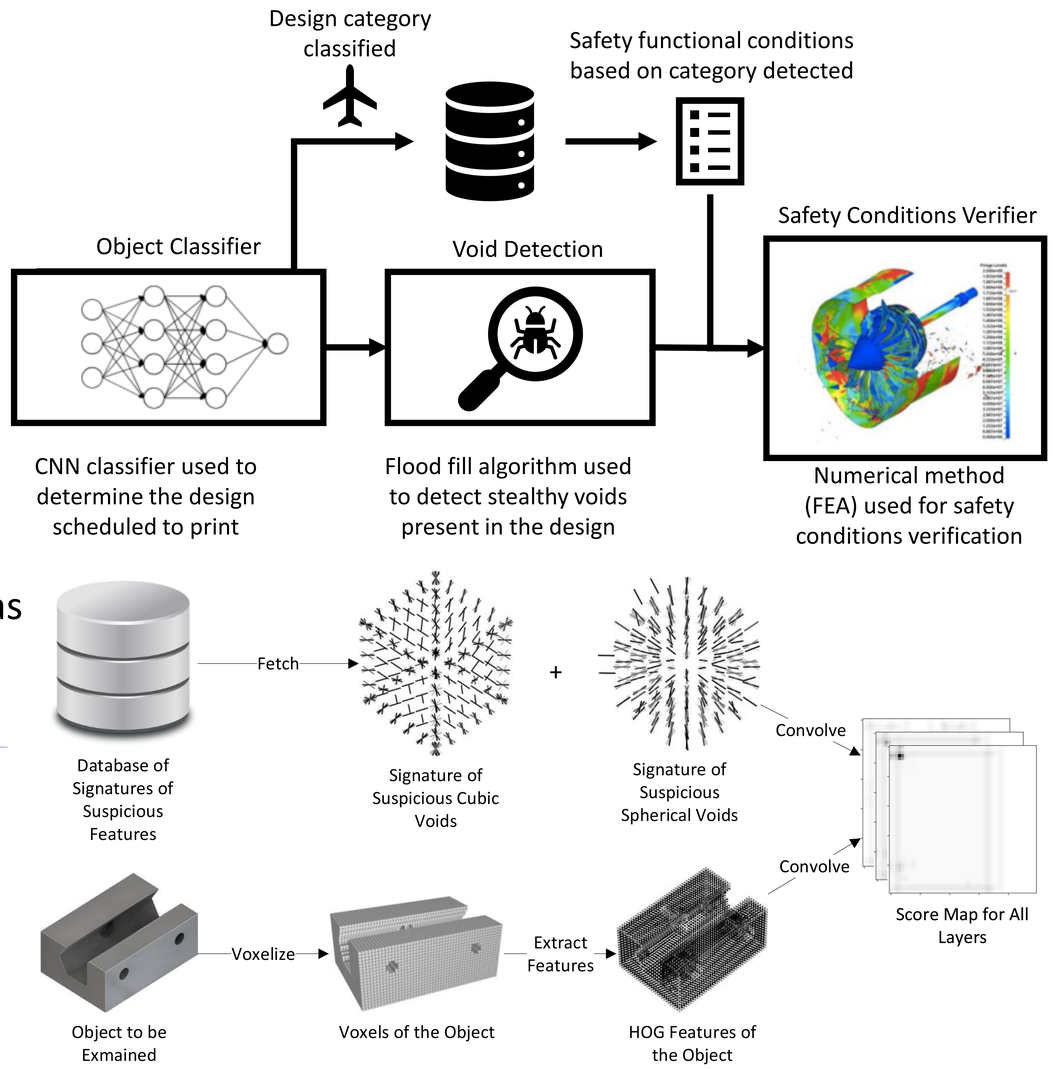
Challenge:

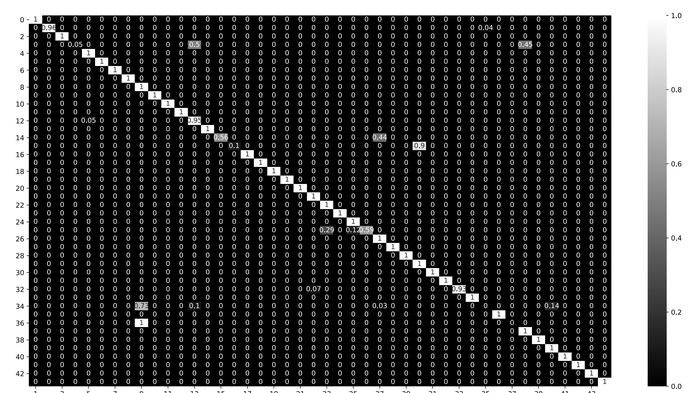
- Efficient search capabilities for 3D printer design files for design distribution and reuse purposes
- Detection of 3D printer design files by third-parties with malicious corruptions before printing
- Search support for partial sub-component search with key words as well as 2D sketches

Solution:

- Online classification and categorization of 3D printer design files using deep neural networks (DSN'21)
- Automated processing of 3D design files and their translation to relevant data structures (e.g., Octrees) for effective malicious defect detection



3D Design Classification Confusion Matrix:



Scientific Impact:

- our automated and robust search algorithms for 3D designs will leverage and complement computer vision-based perception in other CPS domains (e.g., robotics)
- Our efficient detection for malicious stealthy designs complements post-print quality control procedures

Broader Impact:

- This solution would enable end-users without technical expertise to find their designs of interest online in a timely manner
- The malicious designs can be detected effectively before printing
- Edu: we worked with undergraduates on research; and regularly with a female high school student (admitted to Cornell)