CPS: Medium: Collaborative : Frequency Domain Conversion of Computer Aided Design Files to Enable Encryption, Authentication and Feature Search Function

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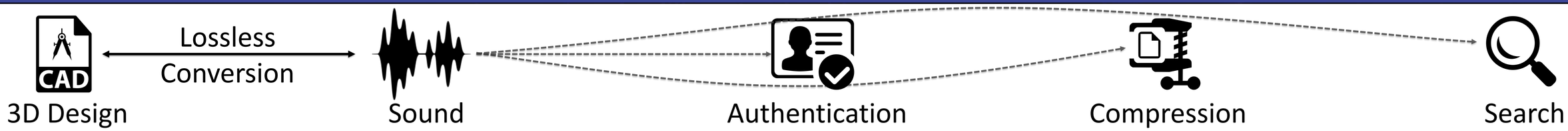
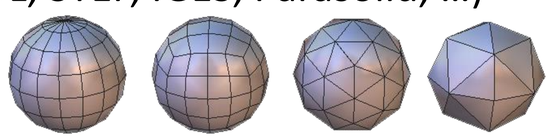


Challenges:

- Multitude of CAD formats (STL, STEP, IGES, Parasolid, …)
- Shapes consist of points and are not directly defined



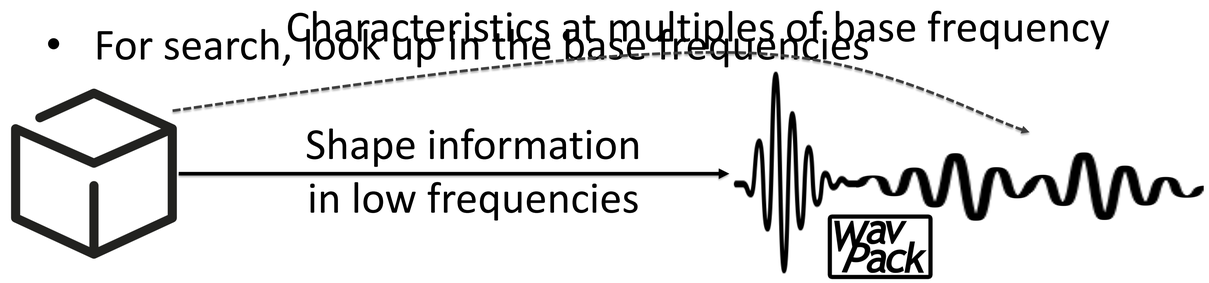
- Many lossless audio compression algorithms (WavPack, FLAC)
- Many different CAD suites, use of different parameters

CAD to Sound:

- Store shape definitions near origin (low frequencies)
- Store shape characteristics at multiples of base frequency
- Represent data as sine waves of varying frequency

Intellectual Merit:

- Develop fundamental principles for converting CAD models to the frequency domain (e.g., audio formats)
- Algorithms to test robustness for lossless conversion
- Search functionality of design features in Freq. domain
- Authentication of CAD files in the Freq. domain
- For search, look up in the base frequencies



Broader Impact on Society:

- 3D printing has grown to $10B in 2019
- Impact on industries using 3D printing (aerospace, automotive, medical etc.)
- Prevent sabotage, theft of design files
- Authenticity of files in online libraries

Broader Impact (Education, Outreach):

- Development of new courses
- Undergraduate research program
- Cybersecurity awareness worldwide events (Hack3D, ESC competitions)
- Public education videos

Broader Impact Quantification:

- The PIs/co-PIs organize international cybersecurity competitions (CSAW)
- Measure ability to convert and recover CAD files to/from Freq. Domain
- Use of realistic CAD models