Problem Statement and Goals

Approach

- Dempster-Shafer theory is used to provide a numerical measurement of confidence in our identities. It assigns mass to sets of elements, with the total mass summing to 1.0.
- The set of all possible elements is the frame of discernment. Uncertainty is preserved by assigning mass to the entire frame.
- Frames of discernment can be analyzed to create new, refined frames in refinements.
- The belief associated with a set is a lower bound on its likelihood and is determined by adding the masses of all of its subsets.
- The plausibility of a set is an upper bound on its likelihood and is the sum of the masses of all sets that overlap with it.
- Dempster-Shafer theory provides a number of rules to combine mass functions while maintaining uncertainty.
- We consider each situation and its associated situations to provide its own mass function and provide evidence for the likelihood that each suspect was the criminal.
- Our scenario provides a numerical similarity measure between each suspect and the crime scene for each piece of evidence (fingerprint and photograph).
- We use Dempster’s rule for combining mass functions and we execute constraints and refinements.
- One situation can carry information about another, and we are part of a group applying this work to model-based design. Regarding the basic classes, the most obvious objects in cyberspace are digital objects.

Results

- Data within our framework is represented using Semantic-Web standards.
- The level of support for a hypothesis that is provided by the evidence is expressed as a numerical value per Dempster-Shafer theory, implemented using the Python programming language.
- We calculate the belief and plausibility of a hypothesis. After combining the evidence, a threshold of guilt can be established based on belief, such as 0.5. Any suspect(s) exceeding the threshold value would be suspected of being guilty.

Future Work

- We will consider different combination rules and applications of Dempster-Shafer theory, look at weighting evidence, increase our set of scenarios.
- Our software will be web-accessible, used by students in the Criminal Justice Program at North Carolina A&T State University.
- We are extending our framework into cyberspace, where identity is a major issue.

Acknowledgements

- This research is based upon work supported by the NSF REU (Grant #1460864) and the Army Research Office (Contract No. W911NF-15-1-0524).

References