Causal Inference for the Detection and Prevention of Nuclear Smuggling

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Abstract

Radioactive substances that are smuggled into the UK present a great threat to national security, and the loss of enriched uranium and contaminated materials pose a significant health risk and environmental hazard. If obtained in sufficient quantities by terrorist groups, these materials could cause significant death, destruction, and general disruption.

Using The Tool

The tool can be used as follows:

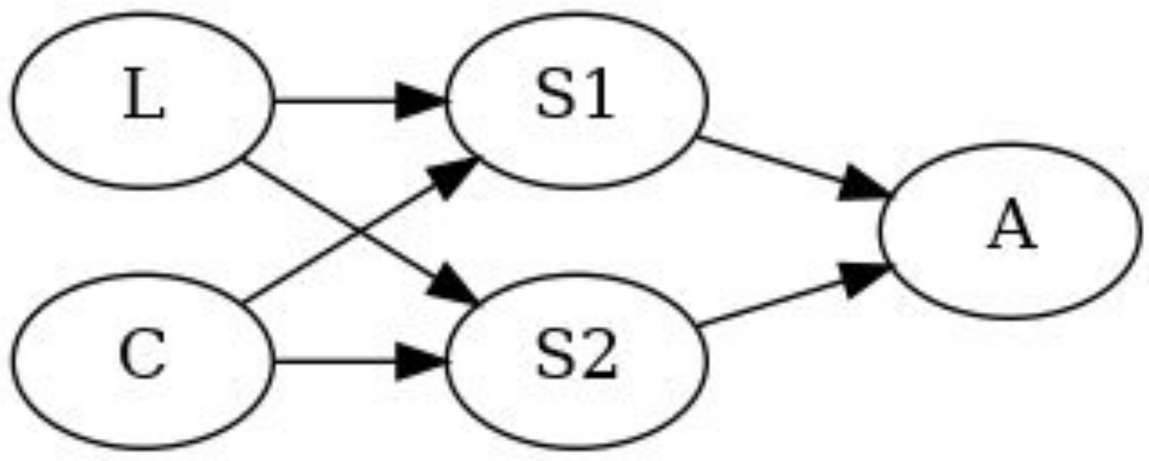
1. Acquire training data: typically a large CSV file containing information about previous shipments and alarm status.
2. Map out the causal structure: DAG and supply variables (nodes of graph) to create a scenario.
3. Estimates counterfactuals: Estimate how much each feature needs to be changed to change the alarm status.

Our software tool colour codes the shipment features to highlight those believed most likely to trigger the alarm.

Causal Inference

Causal Inference is a branch of statistics that aims to estimate the *causal* contribution features to outcomes. This goes beyond traditional techniques, which can only reason about *associations.*

This is done using a Directed Acyclic Graph that shows the causal relationships between the features that make up the data set. From this, we can identify the features which must be *adjusted for* to obtain an unbiassed estimate of the causal effect.



Results

Applying the Causal Inference techniques to an example shipment, we can estimate what parts of the shipment caused the alarm to trigger. We then highlight those features on the DAG to enable a more efficient investigation to be mounted.