**Introduction**

- The statistics of annual traffic congestions in 2012[1]:
  + 5.5 billion hours of extra time
  + 2.9 billion gallons of wasted fuel
  + $121 billion lost in total

- Congestions caused by traffic incident
  + Incidents account for 30% ~ 50% congestions [2]
  + 1 minute an incident in place -> 4 minutes delay [3]

**Motivation**

- Importance of Impact Prediction in ITS
  + To avoid the congestions by smart route planning

**Preliminary**

- Granger Causality [4]
  + We try to predict time series Y, we have two approaches:
    \[
    Y(t) = \sum_{i=1}^{l} a_i Y(t-l) + \epsilon_1, \quad (1)
    \]
    \[
    Y(t) = \sum_{i=1}^{l} a_i Y(t-l) + \sum_{i=1}^{l} b_i X(t-l) + \epsilon_2, \quad (2)
    \]
  + If prediction accuracy of (2) is significantly better than (1), we determine that time series X Granger causes time series Y.

- Lasso – Granger
  + Provide a graphical causality modeling and to reduce the computational complexity of Granger method [6]
  \[
  \min_{a_i} \sum_{t=1}^{n} \left[ X_i(t) - \sum_{j=1}^{l} a_i^j X_j(t-l_j) \right]^2 + \lambda \|a_i\|_1,
  \]
  + \( X_i \) causes series \( X_j \) if and only if \( a_i \) is a non-zero vector.

**Conclusion and Future Work**

- We learn the causality relationship between highways sensors and arterial sensors, and utilize that relationship to predict the impact of traffic incidents.
- We plan continue this impact study on more complex traffic related events, such as sports game or concerts.

**References**


