Predicting Healthcare Insurance Fraud Using Markov Observation Models

University of Alberta

STAT 499, Winter 2024

Abhimanyu Nag

- Huge rise in healthcare fraud
- Markov Observation Model (MOM) offers promise
- The MOM expands upon the Hidden Markov Model framework

Overview of Concepts

- Stochastic Process
- Markov Chain
- Hidden Markov Model (HMM)
- Markov Observation Model (MOM)

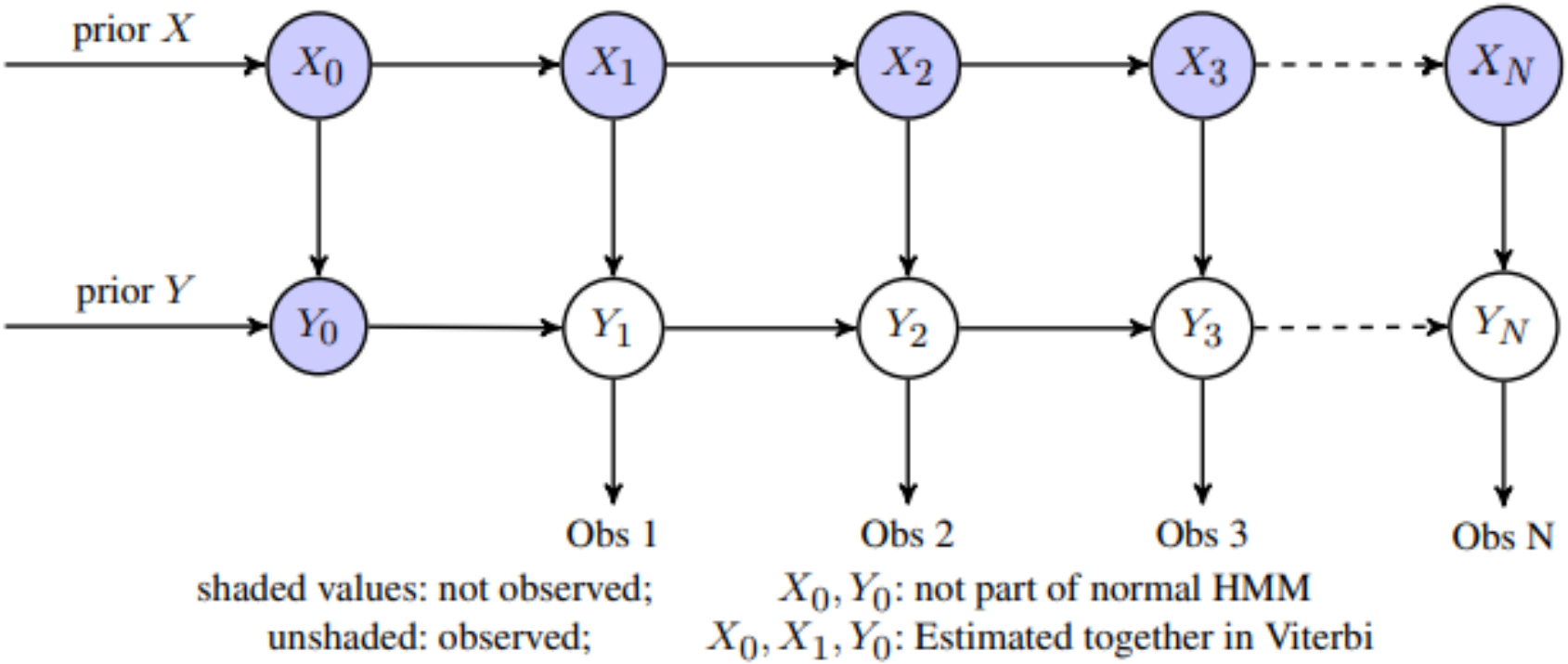

Figure: Markov Observation Model Structure

Research Question

Can we use the Markov Observation Model (MOM) on a large scale healthcare insurance dataset to quantify and predict fraudulent insurance claims and even model mindsets of the exact perpetrators of the crime?

Research Question

Can we use the Markov Observation Model (MOM) on a large scale healthcare insurance dataset to quantify and predict fraudulent insurance claims and even model mindsets of the exact perpetrators of the crime?

We claim that we can

HOW?

How?

- Utilization of a canned dataset with 9 columns and 636,000 data points

How?

- Utilization of a canned dataset with 9 columns and 636,000 data points
- Define transaction marks and partition transactions into bins.

How?

- Utilization of a canned dataset with 9 columns and 636,000 data points
- Define transaction marks and partition transactions into bins.
- Define event types E_i for each claim and create observations Y_t representing mark occurrences

How?

- Utilization of a canned dataset with 9 columns and 636,000 data points
- Define transaction marks and partition transactions into bins.
- Define event types E_i for each claim and create observations Y_t representing mark occurrences
- Construction of a canonical model $q_{y \to y'}$ considering all providers

- Utilization of the EM algorithm to model each provider's behavior

- Utilization of the EM algorithm to model each provider's behavior
- Employing Markov Observation Model (MOM) prediction from deviant states to predict fraud based on price changes associated with marks.

Conclusion and Future Work

We expect the Markov Observation Model to tell us which service providers have been defrauding insurance providers through modelling the mindsets.

Aim to motivate and popularize the use of this algorithm in more areas such as network security and economic modelling

References

Kouritzin, Michael A. "Markov Observation Models." *arXiv preprint arXiv:2208.06368* (2022)

Baum, L. E. and Petrie, T. (1966). Statistical Inference for Probabilistic Functions of Finite State Markov Chains. The Annals of Mathematical Statistics. 37 (6): 1554-1563. doi:10.1214/aoms/1177699147.