



Graphical Modelling on GB Road Accident Databases

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4 A result!

The data

STATS19

- Personal injury road accident data in GB
- Accident, vehicle, casualty information → multi-variate
- Causation information
- Collected by Police → missing data

MG NSR/FA ACCIDENT STATISTICS Incident UEN Other ref:

1.3 ACCIDENT REFERENCE

*FATAL / SERIOUS / SLIGHT

1.9 TIME DAY+ Su M T W Th F S 1.7 DATE

1st Road Class & No. 1st Road Name
or (Unclassified - UC) (Not Known - NK)

Outside House No. at junction with / or metres * of
or Name or Marker Post No.

2nd Road Class & No. 2nd Road Name
or (Unclassified - UC) (Not Known - NK)

Town Sector / Beat No.

County or Borough

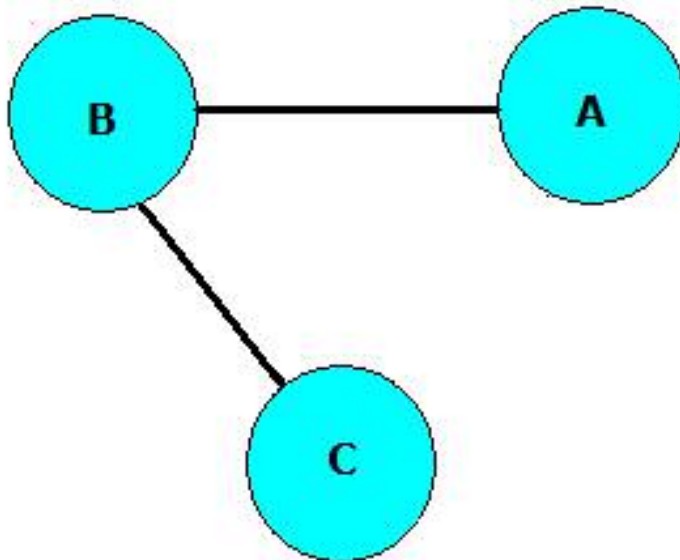
Farish No. or Name 1.10 Local Auth No. (if known)

1.11 Grid Reference

REPORTING Name Number
 OFFICER BCU/Str 1.2 Force Tel Number

1.5 Number of vehicles <input type="text"/>	1.20a PEDESTRIAN CROSSING - HUMAN CONTROL <input checked="" type="checkbox"/>	1.21 LIGHT CONDITIONS <input checked="" type="checkbox"/>
1.6 Number of casualties <input type="text"/>	None within 50 metres <input type="text"/>	Drylights: street lights present <input type="text"/>
1.14 ROAD TYPE <input checked="" type="checkbox"/>	Control by school crossing patrol <input type="text"/>	Daylight: no street lighting <input type="text"/>
Roundabout <input type="text"/>	Control by other authorised person <input type="text"/>	Daylight: street lighting unknown <input type="text"/>
One way street <input type="text"/>	1.20b PEDESTRIAN CROSSING - PHYSICAL FACILITIES <input checked="" type="checkbox"/>	Darkness: street lights present and lit <input type="text"/>
Dual carriageway <input type="text"/>	No physical crossing facility within 50m <input type="text"/>	Darkness: street lights present but unlit <input type="text"/>
Single carriageway <input type="text"/>	Zebra crossing <input type="text"/>	Darkness: no street lighting <input type="text"/>
Slip road <input type="text"/>	Follies, puffs, rascals or similar non-junction pedestrian light crossing <input type="text"/>	Darkness: street lighting unknown <input type="text"/>
Unknown <input type="text"/>	Pedestrian phase at traffic signal junction <input type="text"/>	1.24 SPECIAL CONDITIONS AT SITE <input checked="" type="checkbox"/>
1.15 Speed Limit (Permanent) <input type="text"/>	Footbridge or subway <input type="text"/>	None <input type="text"/>
1.16 JUNCTION DETAIL <input checked="" type="checkbox"/>	Central refuge — no other controls <input type="text"/>	Auto traffic signal out <input type="text"/>
Not at or within 20 metres of junction: <input type="text"/>	1.22 WEATHER <input checked="" type="checkbox"/>	Auto traffic signal partially defective <input type="text"/>
Roundabout <input type="text"/>	1.22 WEATHER <input checked="" type="checkbox"/>	Permanent road signing or marking defective or obscured <input type="text"/>
Mini roundabout <input type="text"/>	1.22 WEATHER <input checked="" type="checkbox"/>	Roadworks <input type="text"/>
T or staggered junction <input type="text"/>	1.22 WEATHER <input checked="" type="checkbox"/>	Road surface defective <input type="text"/>
	1.22 WEATHER <input checked="" type="checkbox"/>	Oil or diesel <input type="text"/>
	1.22 WEATHER <input checked="" type="checkbox"/>	Mud <input type="text"/>

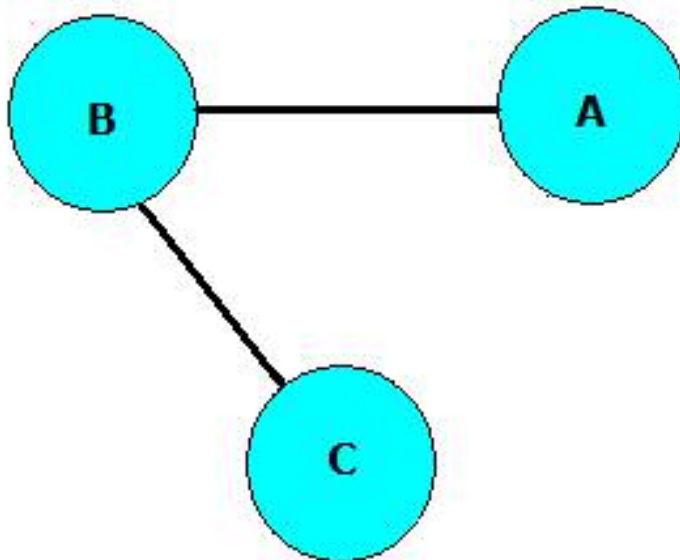
The technique



Graphical Modelling

- Multi-variate statistical technique
- Combination of probability theory and graph theory
- Build complex models by combining simpler parts
- Join dependent variables together with an edge

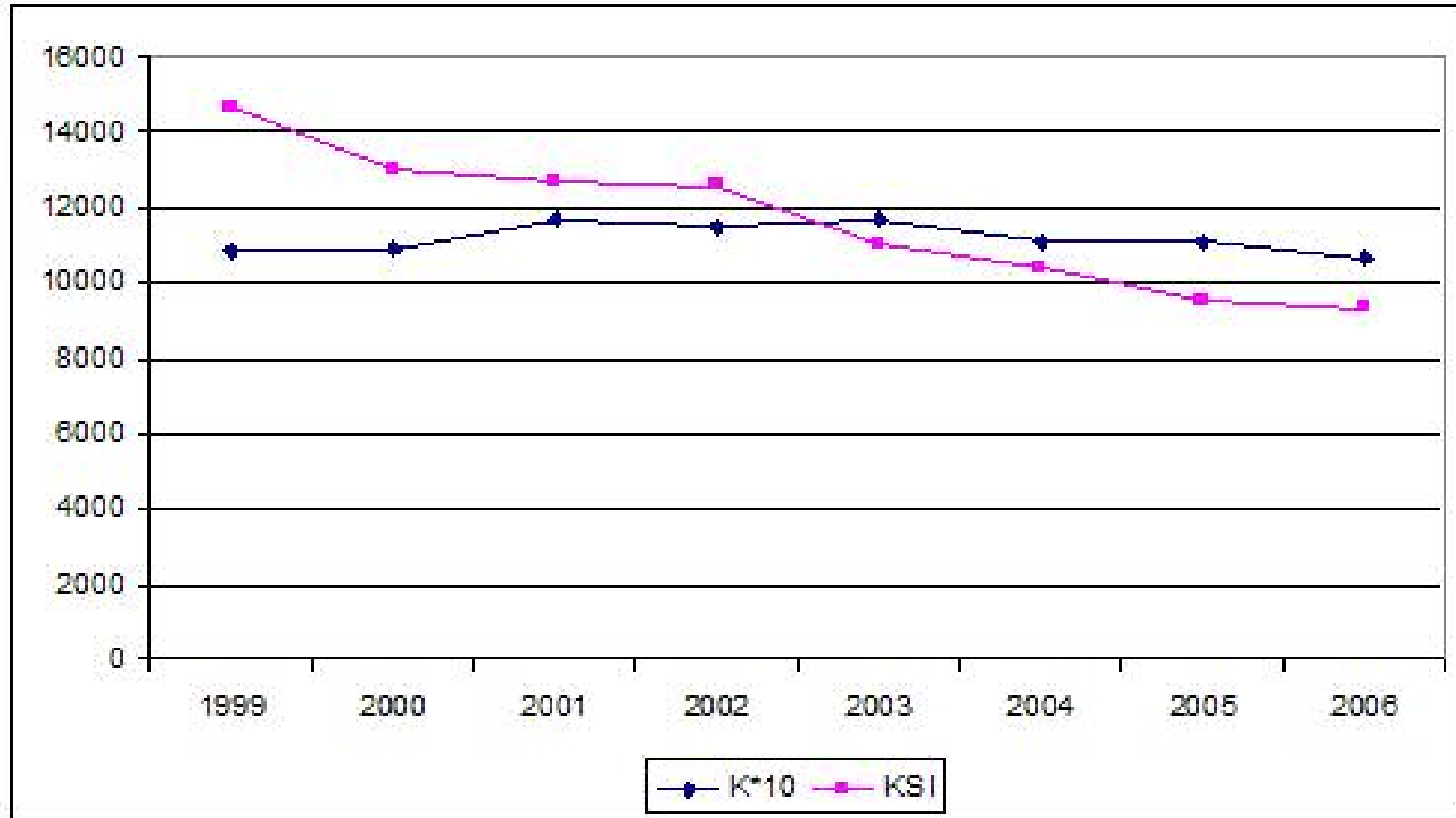
The technique



Conditional independence

- Join **dependent** variables together with an edge
- Un-joined variables are **conditionally independent**

The problem



The problem

Increases in:

- Number of single vehicle accidents
- Severity of single vehicle accidents
- Overturning injuries
- Accidents at bends
- Fatality rate of 4x4 drivers



The problem

Increases in:

- Number of single vehicle accidents
- Severity of single vehicle accidents
- Overturning injuries
- Accidents at bends
- Fatality rate of 4x4 drivers

Due to:

- Decrease in driving standards?
- Increase in proportion of 4x4s on the road?

Single vehicle accidents

Year	Overturning	
1999	11%	
2000	12%	
2001	12%	
2002	13%	
2003	15%	
2004	15%	
2005	16%	
2006	16%	

Single vehicle accidents

Year	Overturning	Bend
1999	11%	28%
2000	12%	28%
2001	12%	28%
2002	13%	30%
2003	15%	30%
2004	15%	30%
2005	16%	30%
2006	16%	30%

Which accident variables directly influence accidents?

Accident variables

Increases in:

- Number of single vehicle accidents
- Severity of single vehicle accidents
- Overturning injuries
- Accidents at bends
- Fatality rate of 4x4 drivers

Variables

Accident

- Year – 1999-2006
- Road – M'way, A road, other
- Rural/Urban
- Bend?

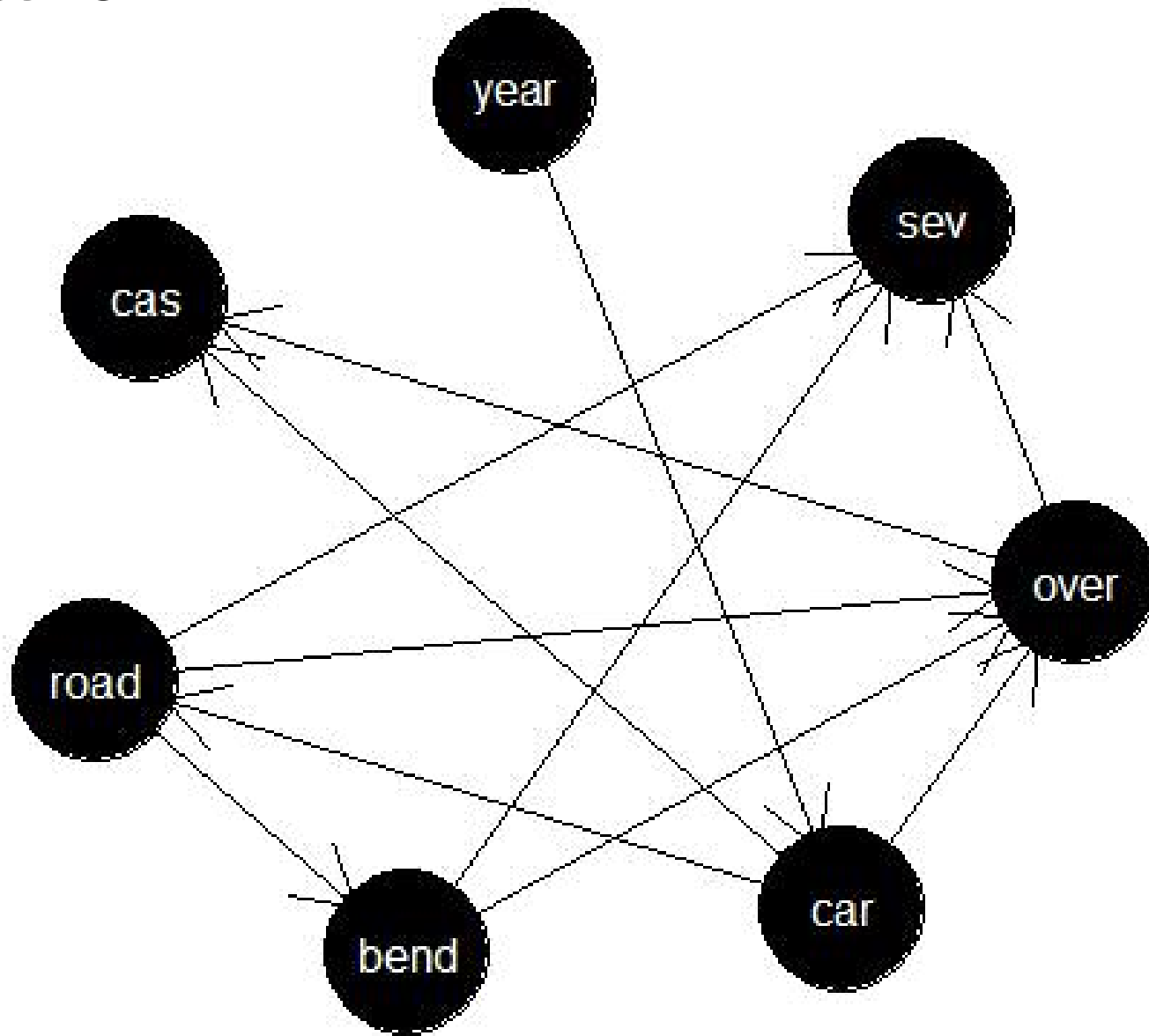
Vehicle

- Car type – from mini to 4x4
- Overturned?

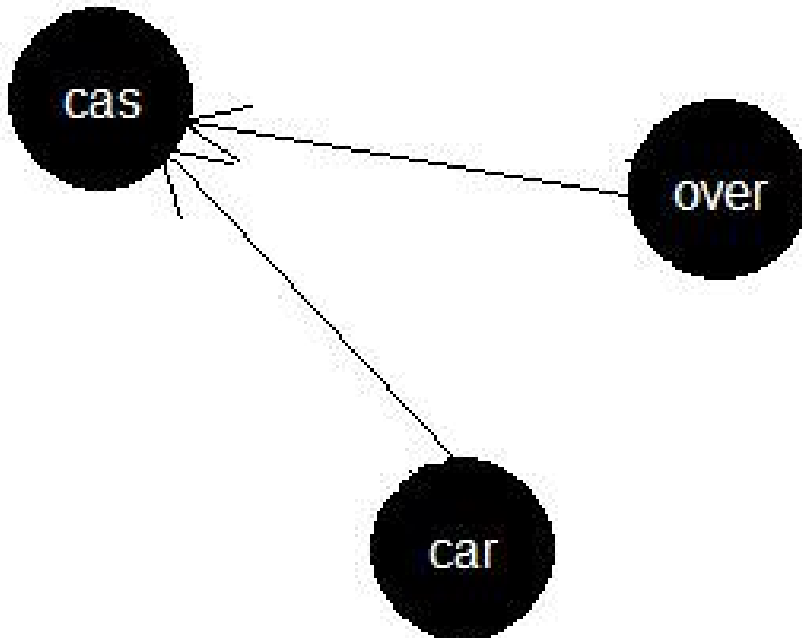
Occupant

- Severity – killed / seriously injured
- Casualty type – driver, fsp, rsp

The network



Network links



Casualty type

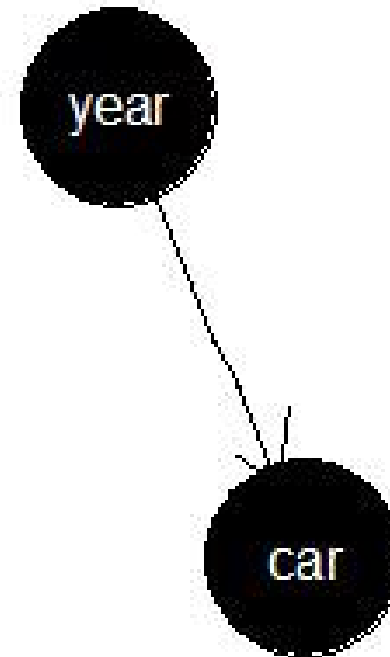
- Casualty type dependent on overturning and car type
- High proportion of injured drivers in small cars that do not overturn
- High proportion of fsp in sports cars that do overturn
- High proportion of rsp in small cars that overturn

- Difference in casualty type by car type at least partially due to exposure

Network links

Car type

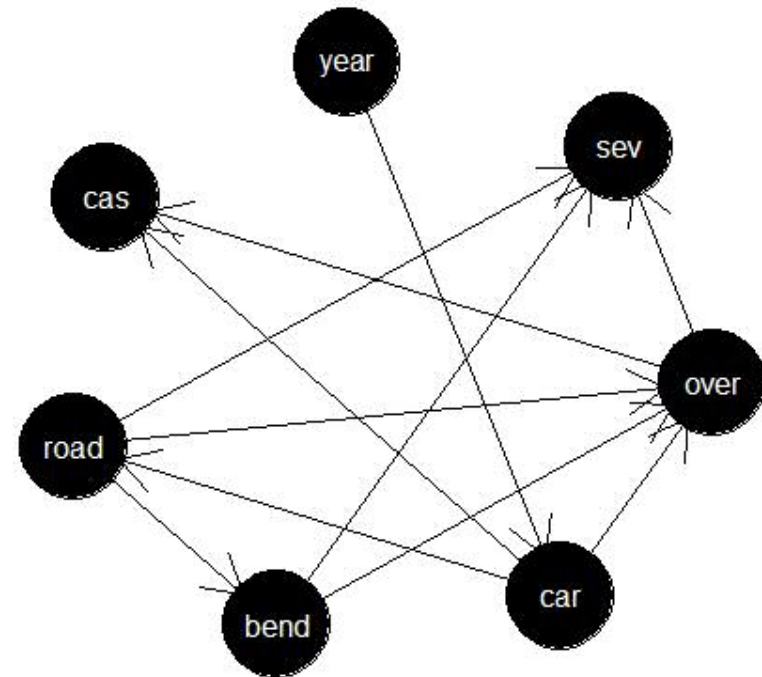
- Distribution of type of car involved in accidents differs by year
- Increase in accidents involving 4x4s, mini and sports cars
- Decrease in proportion of accidents involving large, medium and small cars
- Distribution of car types on road changed



Missing links

Conditional independences

- Severity and car type
- Severity and casualty type
- Year and severity
- Year and overturn
- Year and bend



Next steps

Exposure data

- How much is the difference in casualty type by car type due to exposure?
- Is the link year → car due to accident distributions changing or just due to a change in vehicles on the road network?



Thank you