



# AUTOMOBILE INSURANCE FRAUD DETECTION USING EVIDENTIAL REASONING AND DATA-DRIVEN INFERENTIAL MODELLING

**XI LIU** 14 June 2019

# Insurance Fraud Cost

<https://www.kennedyslaw.com/thought-leadership/blogs/fraud-blog-fundamentally-honest>

£ 1.3  
BILLION



UK insurers  
detected & prevented



£ 2  
BILLION

**Undetected fraud**  
Calculated by Insurance  
Fraud Taskforce



£ 200  
MILLION

in the cost of measures  
**ANNUALLY.**

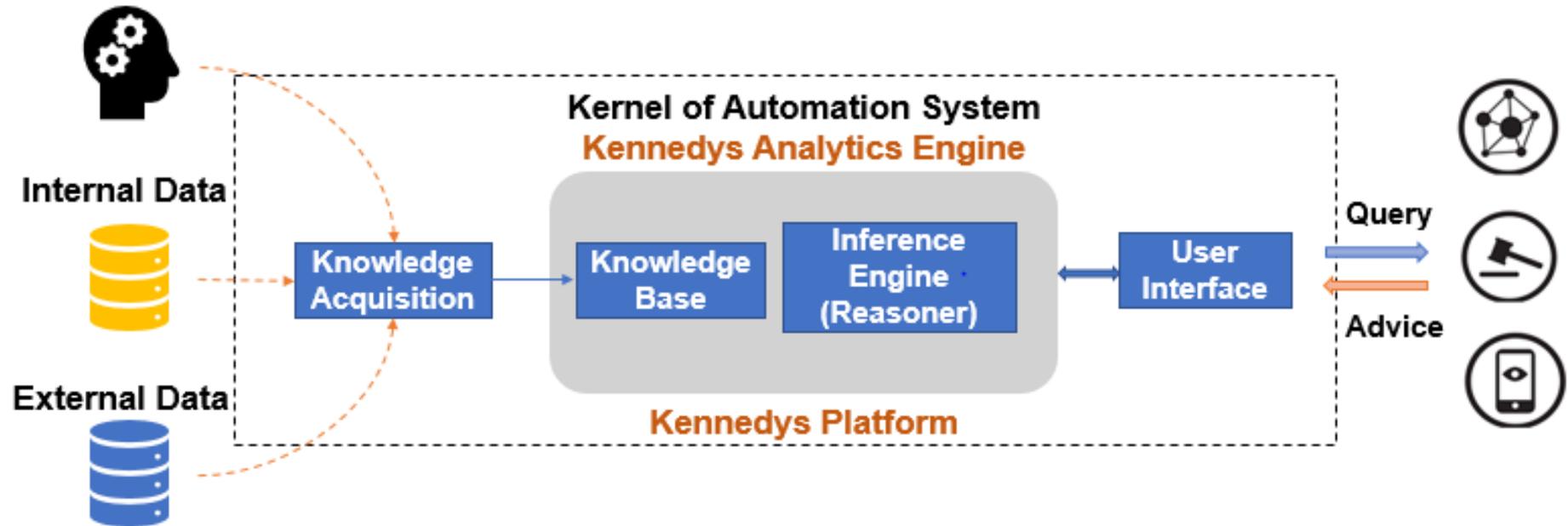
\$ 40  
BILLION



The Yearly Impact  
Of Insurance Fraud in the U.S.

# Decision Support System

Expert Knowledge



**Black-Box ML**



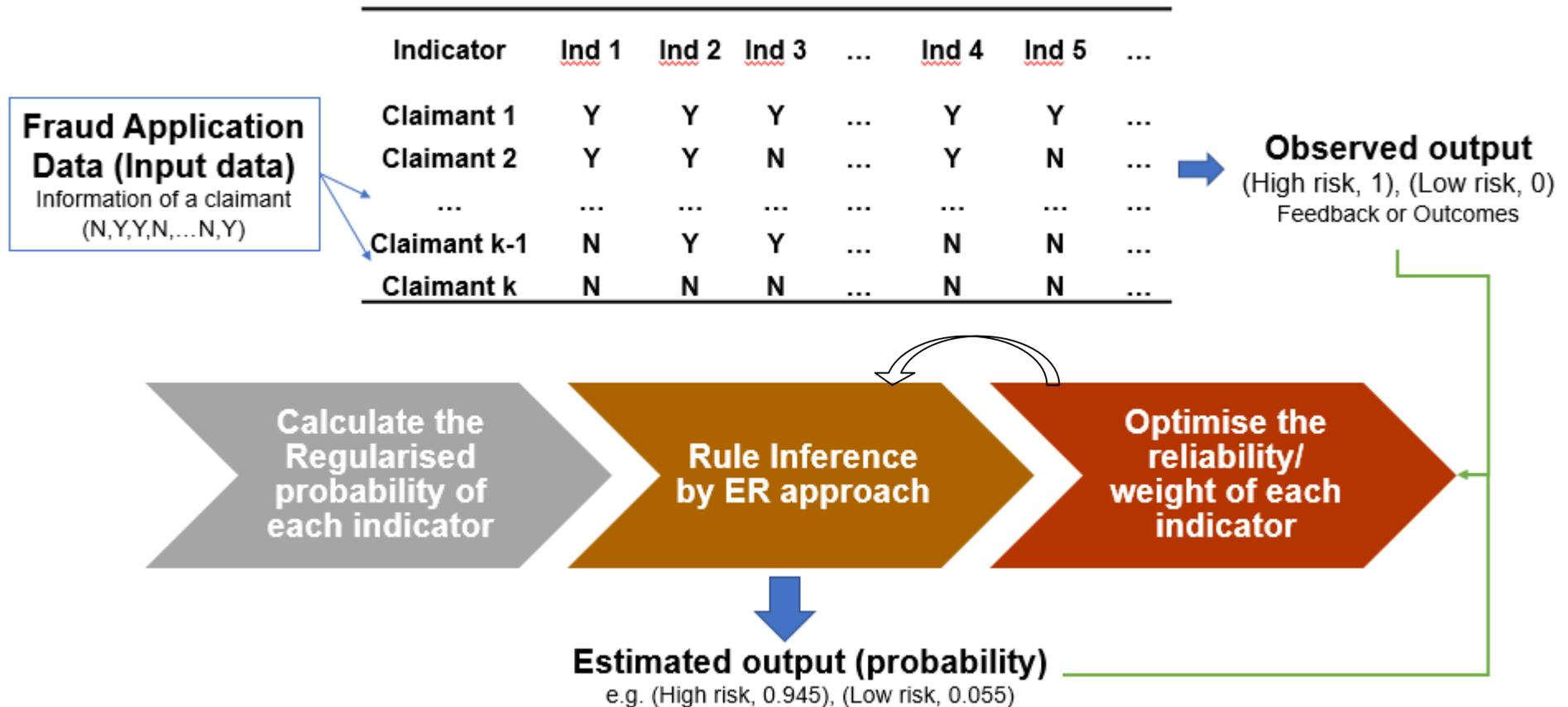
**Or**

**Interpretable ML**



# Probabilistic Expert System

## Evidential Reasoning (ER)



# Performance

## Real Data

### Performance Measure

#### 1. Confusion matrix

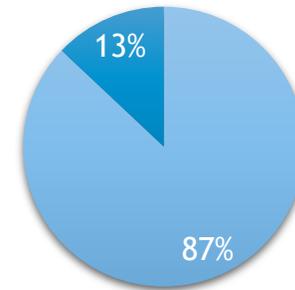
		PREDICTED GROUP	
		0	1
ACTUAL GROUP	0	TN: Number of Fraudulent cases that are predicted to be Fraudulent	FP: Number of normal cases that are predicted to be Fraudulent
	1	FN: Number of Fraudulent cases that are predicted to be Normal	TP: Number of normal cases that are predicted to be Normal

$$2. \text{ Accuracy} = \frac{TP+TN}{TP+FP+FN+TN}$$

$$3. \text{ F1 Score} = 2 * \frac{\text{Recall} * \text{Precision}}{\text{Recall} + \text{Precision}}$$

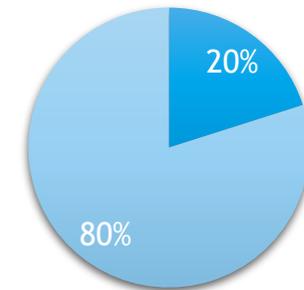
#### 4. Receiver operating characteristic

### Training sample



■ Low risk ■ High risk

### Test Sample



■ High risk ■ Low risk

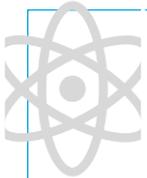
477 training 241 test sample	Confusion matrix		Accuracy	F1 score	AUC
<b>ER</b>	<b>110</b> <b>85</b>	<b>11</b> <b>35</b>	0.6017	<b>0.4217</b>	<b>0.6814</b>
ANN	167 20	41 6	0.751	0.1667	0.5718
Random Forest	195 0	45 1	0.8133	0.0426	0.5799
Decision Tree	195 0	46 0	0.8091	NA	0.5

# Beyond Fraud

Augmenting legal expertise in general



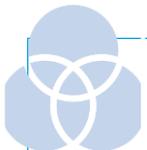
**Data-Driven**  
+  
**Experienced Knowledge**



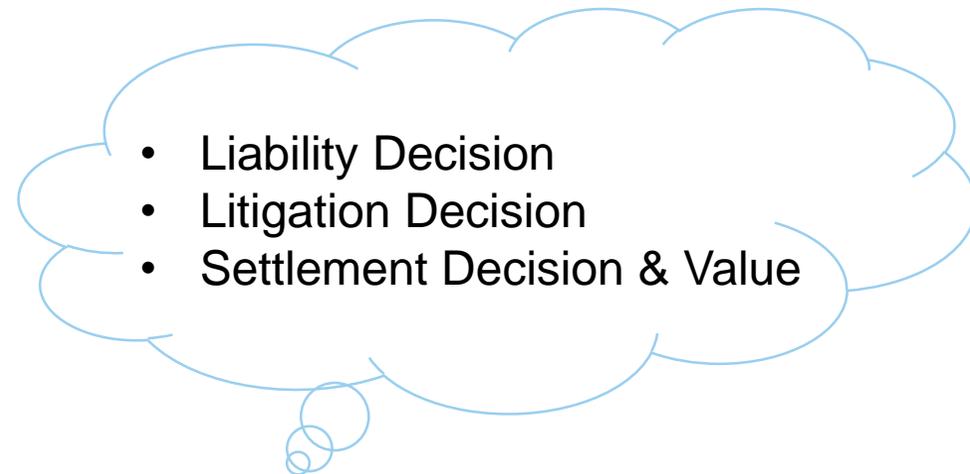
No information loss or distortion during data transformation.



**Reliability** → Identification ability of indicator and its evidence.



**Weight** → Relative importance compared with other evidence.





Prof Jian-Bo Yang  
Prof Dong-Ling Xu  
Karim Derrick  
Chris Stubbs  
Martin Stockdale

Chair of Decision and Systems Sciences, The University of Manchester  
Prof. in Decision Sciences and Systems, The University of Manchester  
Head of Research and Development, Kennedys Law LLP  
Head of Intelligence, Kennedys Law LLP  
Partner, Kennedys Law LLP

# THANK YOU

Contact: [xi.liu@kennedyslaw.com](mailto:xi.liu@kennedyslaw.com)

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