

TERROR ATTACK CLASSIFIER

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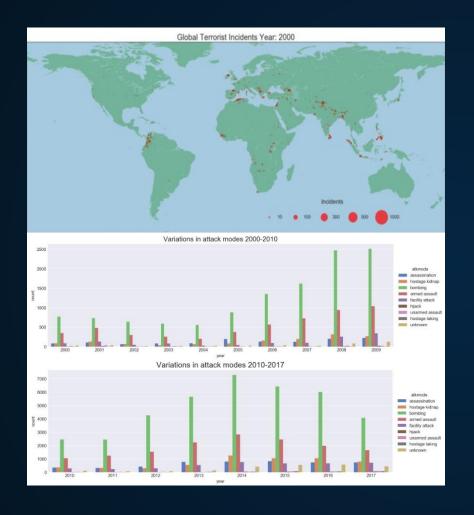




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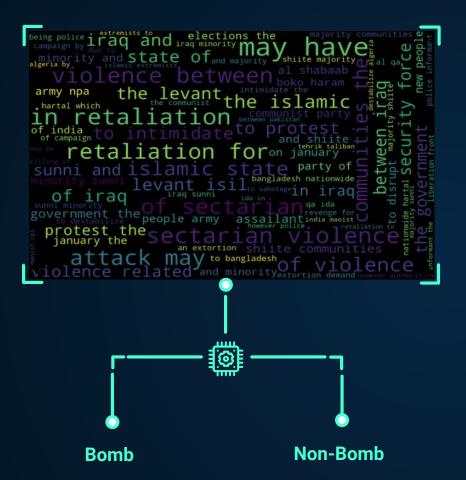
Try out the Classifier!



PROBLEM STATEMENT

Can we predict the probability of a terrorist bombing incident, based on intel text (terror group motive) and alleviate manpower constraints at the same time?

- Counter terrorism relies on intelligence to foil terror incidents.
- The analysis of intel data requires much manpower and training.
- Intel collected has exponential growth with tech advancement
- Bombing (green bar) accounted for more than half of all terror attack modes combined.



PROPOSED SOLUTION

Model to classify expected terrorist incident

Binary classification; Bomb (positive class) vs.
 Non-Bomb (negative class)

Model envisaged to:

- augment intelligence analysts
- improve CT efficiency

GTD DATASET

SHAPE

181,691 X 135

CHARACTERISTICS

Maintained by: Uni. Maryland

Size: 150MB

Format: ISO-8859-1 Lineage: 1970-2017

Shifts in data collection:

Jan 1998, Apr 2008, Jan 2012

New Variables: added post-1997

Automated processing: since 2012

Variables describing:

Time, Location,
Perpetrator
(Group, Motive, Weapon used, Incident category)
Target

(Nationality, Name)

Terrorism Criterion (per GTD definition)

Outcome (Success/ Failure)
Casualties / Property Damage

FEATURE OF INTEREST

Time
Location
Perpetrator
Target
Casualties

DATA CLEANING CHALLENGES

Missing Values

- Several variables (post-1997) missing values (> 100,000)
- Inadequate information in some motive texts (blank entries)

Mitigation:

- Drop all except for motive (50561 observations)
- Drop the motive rows w/o sufficient information

Inconsistent Variable Labels

• Categorical feature names inconsistent with data dict.

Mitigation:

Defined new set of categorical features

Identifying Features of Interest

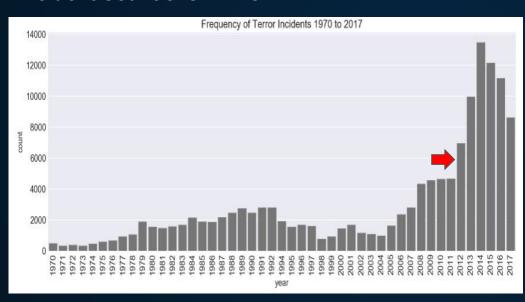
- High number of features
- No contextual understanding if go for motive text directly
- New features required for insights (incidents attributable to group, attack modes per group, etc.)

Mitigation:

- Review data dictionary for all 135 variables
- Pare down relevant features for EDA, document decisions made.
- Feature engineer pos/ neg class labels
- Use Groupby, count or sum to derive new features
- Cleaned data shape 32521 x 23 (still sizable for modelling)

EDA

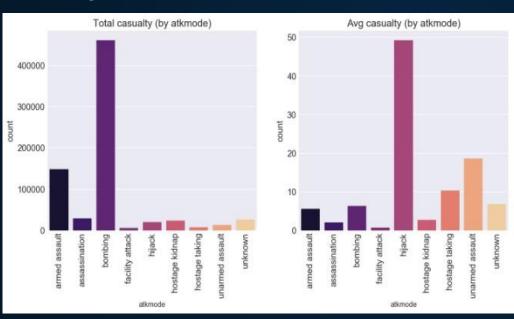
Incident Count over Time



• Sharp increase in incident counts from 2012 onwards

EDA

Bombing Casualties



- From earlier chart, no fundamental shift in the general modes of attacks over the years.
- Bombing remains the favored tactic followed closely by armed assault and kidnapping in more recent years.
- Bombing accounts for highest casualties (total); hijacking accounts for highest average casualties.

EDA

Word Cloud (Motive Text)

- Many factors driving terror incidents (social, ideology, political, sectarian, etc.)
- Common underlying theme being sectarian violence

MODELLING

Model Metric

- Sensitivity
- Roc_auc

Positive class

• Bomb (48%)

Processing

- nltk stopwords
- custom stopwords
- nltk porterstemmer

Data

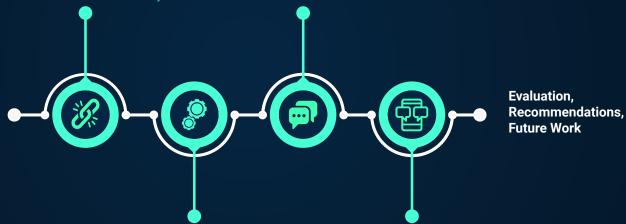
• train, validate, test sets

Pipeline (Train/validate set)

- sklearn CountVectorizer
- Logistic Regression
- Multinomial NaiveBayes

Topic Modelling

- Optimum topics (entire traindata)
- LDA model for classification



Tuning (Entire train/test)

• custom stopwords

Topic Probabilities + Word Vectors

Production model (train/test set)

EVALUATION

Pipeline

Metrics	LR	NB
accuracy	0.6781	0.6593
sensitivity	0.8532	0.8246
roc_auc	0.7460	0.7272

Tuning

Metrics	LR	LR1	LR2
accuracy	0.6898	0.6859	0.6802
sensitivity	0.8584	0.8619	0.8526
roc_auc	0.7620	0.7568	0.7489

Note:

LR1: 50 words contributing to false negative class removed LR2: overlap words (more than 1200 occurrences) removed

EVALUATION

Topic Modeling

Metrics	Validate	Test
accuracy	0.5820	0.6034
sensitivity	0.8024	0.8106
roc_auc	0.6121	0.6374

Topic Modeling + Word Vectors

Metrics	LR	LR (tm)	LR(tm+wrd vectors)
accuracy	0.6859	0.6034	0.6893
sensitivity	0.8619	0.8106	0.8587
roc_auc	0.7568	0.6374	0.7621

Note:

tm: model using topic probability distributions (tpd) tm+wrd vectors: model using tpd + word vectors

RECOMMENDATIONS

- Model generalizability using topic modeling for classification demonstrated
- Best model remains the Logistic Regression model using count vectorized word features.

Limitations

- Current model very simplistic; classifies solely on one form of intel (motive text).
- Additional intel sources, political and social trends that could serve as supporting sources of intelligence not considered.

Future Work

- Additional data to widen perspective
- Feature engineer spatial and temporal aspects (e.g. attacks by region, attacks by decades)
- Explore use of Tfidf vectorizer and spaCy

Deployment

Invitation to try out the classifier at url: https://enigmatic-reef-60524.herokuapp.com/

Appreciate feedback at slack (dm)

Text Classifier to determine Terrorist Bombing Incidents

Terrorism

is defined as:

"The threatened or actual use of illegal force and violence by a non-state actor to attain a political, economic, religious, or social goal through fear, coercion, or intimidation." - Global Terrorism Database

The Global Terrorism Database (GTD) is an opensource database on terrorist attacks around the world from 1970 through 2017. It includes both domestic and international terrorist incidents, and more than 100 variables on the location, tactics, perpetrators, targets, and outcomes. The database is maintained by the ""National Consortium for the Study of Terrorism and Responses to Terrorism (START), University of Maryland (2018).

Try to beat the classifier!

Ten intel texts describing the terrorist's motives were curated from the GTD, of which five are attributed to actual bombing incidents. Select one and determine if the attackmode will be bomb or non-bomb attack mode, then click the submit button for model classification.

motive [the specific motive is unknown; however, sources noted that the targeted bookstore had links to casa pound, a right-wing group.

Click on the button below to reveal which are actual bombing incidents.

Which are actual bombing incidents?



THANKS! QUESTIONS?

CREDITS

- DSI 14 Instructor and TAs for their patience and guidance
- Work by Marc Kelechava's work on unsupervised nlp topic modeling as a supervised learning input
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