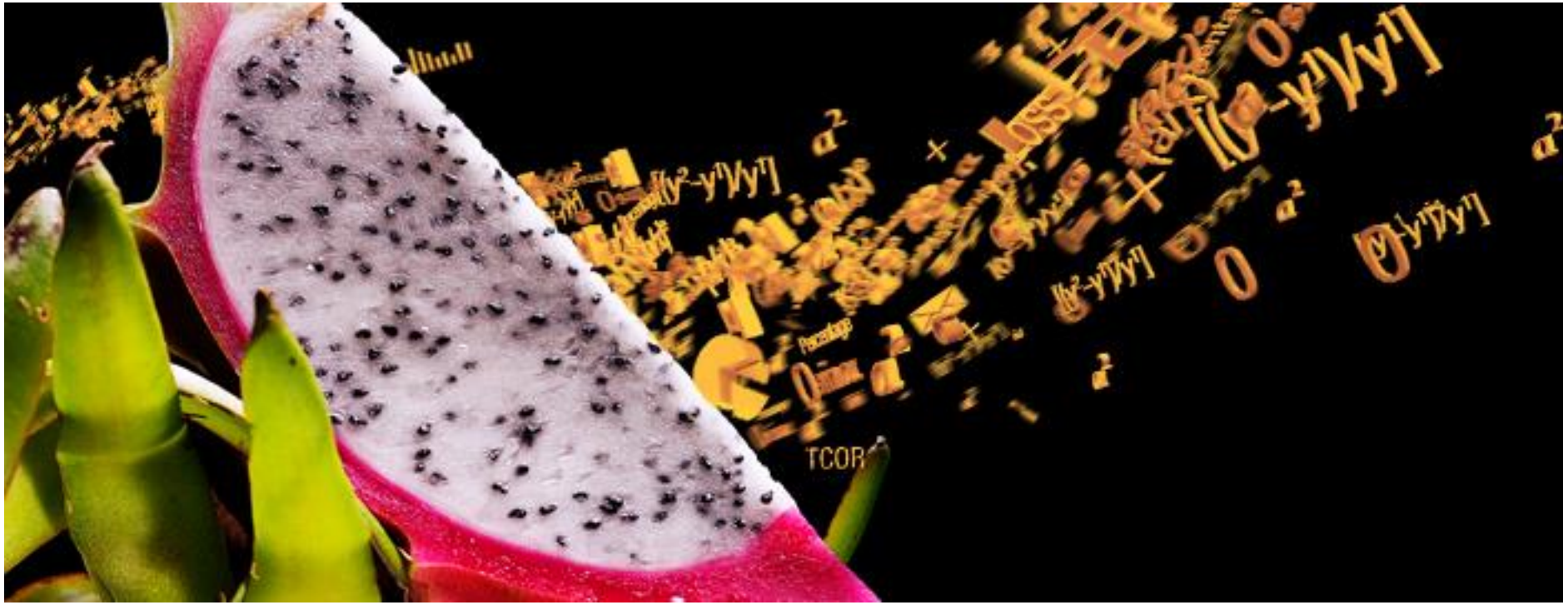

# Broker (R)Evolution
## The Changing Role of a Broker

Aon Benfield Analytics, Asia Pacific



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# Aon Benfield
# From Placement to Risk and Capital Management Advisory

- Reinsurance structuring
- Market intelligence
- Negotiation and placement
- Policy administration
- Run off management

**Transactional broking only**
**1990's**

**Local**

- **Catastrophe management**
- **Reinsurance & portfolio optimisation**
- **Peer analysis/benchmarking**
- **Market analysis**
- **Rating advisory**
- **Security analysis**
- **M&A and Capital Market**
- **Liability management**
- Reinsurance structuring
- Market intelligence
- Negotiation and placement
- Policy administration
- Run off management

**+ Advisory**
**2000's**

**Regional**

- **Multi-model risk assessment**
- **Proprietary models & solutions**
- **Reinsurance as capital**
- **Analytics Product and Solutions**
- **Risk and Capital Strategy**
- **Strategic Consulting**
- **Life Reinsurance**
- Catastrophe management
- Reinsurance & portfolio optimisation
- Peer analysis/benchmarking
- Market analysis
- Rating advisory
- Security analysis
- M&A and Capital Market
- Liability management
- Reinsurance structuring
- Market intelligence
- Negotiation and placement
- Policy administration
- Run off management

**+ Consulting**
**2010's**

**Global**

# Remaining Relevant

- Insurance, more than risk transfer, is as an enabler of sound risk management practices and signalling mechanism – it puts an economic cost to risk to help manage uncertainty

**“From the market perspective, it’s vital that someone takes the lead in developing a holistic understanding of global emerging risks and then facilitates collaborative ways to economically manage certain risks across all stakeholders, private and public. Given brokers’ role and position within the market, they are the natural candidates to undertake this expanded risk facilitation role”**

*PwC Insurance*

1. **Identify, quantify and manage** a wide spectrum of emerging or as yet ambiguous threats

2. **Mobilise** corporations, insurance/reinsurance companies, capital markets, and global governments to develop a better understanding of certain threats and more efficient strategies to manage them over time.

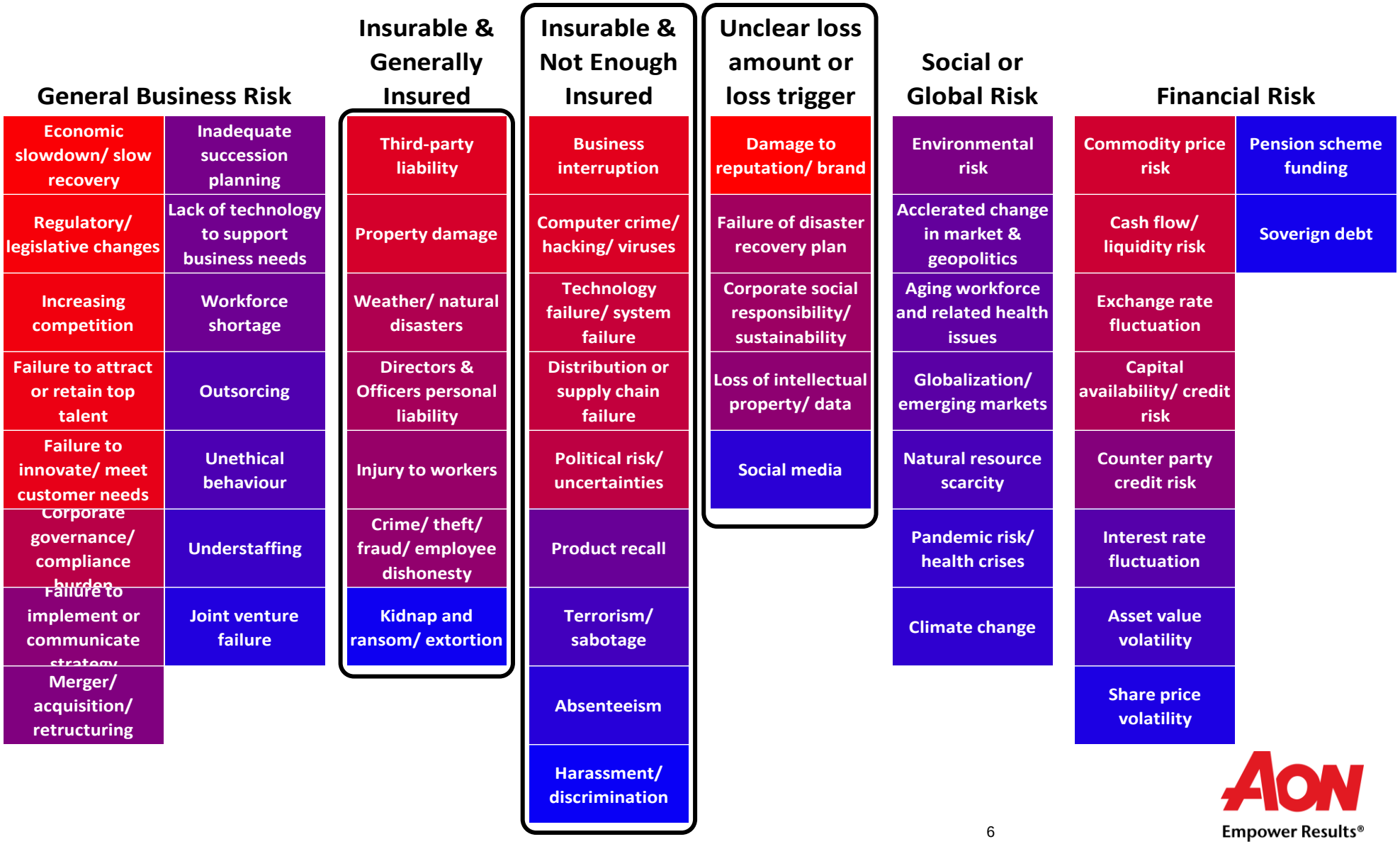
3. **Design** the right mix of self insured retention, insurance, reinsurance, and capital market risk mitigation solutions.

# Product Development

# Aon Risk Manager Survey
# Top Risks

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Damage to reputation/ brand | Economic slowdown/ slow recovery | Regulatory/ legislative changes | Increasing competition | Failure to attract or retain top talent | Failure to innovate/ meet customer needs | Business interruption | Third-party liability | Computer crime/ hacking/ viruses |
| Property damage | Commodity price risk | Cash flow/ liquidity risk | Technology failure/ system failure | Distribution or supply chain failure | Political risk/ uncertainties | Corporate governance/ compliance burden | Exchange rate fluctuation | Weather/ natural disasters |
| Capital availability/ credit risk | Directors & Officers personal liability | Failure of disaster recovery plan | Corporate social responsibility/ sustainability | Injury to workers | Crime/ theft/ fraud/ employee dishonesty | Loss of intellectual property/ data | Failure to implement or communicate strategy | Counter party credit risk |
| Merger/ acquisition/ retructuring | Environmental risk | Inadequate succession planning | Lack of technology to support business needs | Workforce shortage | Product recall | Acclerated change in market & geopolitics | Aging workforce and related health issues | Globalization/ emerging markets |
| Interest rate fluctuation | Outsorcing | Unethical behaviour | Natural resource scarcity | Terrorism/ sabotage | Asset value volatility | Understaffing | Pandemic risk/ health crises | Climate change |
| Social media | Absenteeism | Joint venture failure | Share price volatility | Pension scheme funding | Soverign debt | Kidnap and ransom/ extortion | Harassment/ discrimination | |

# Aon Risk Manager Survey
# Where are the Potential Product Opportunities?



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# Distribution/Supply Chain Failure

- An area being explored at the moment
- Objective is to find links between an entity and its suppliers, customers, and competitors and to work out how exposed the entity to supply chain failure (e.g. disruption from a Nat cat event)
- Link internal data with possible third party data sources
- Initial stage - Use text mining techniques to identify chain links using keywords




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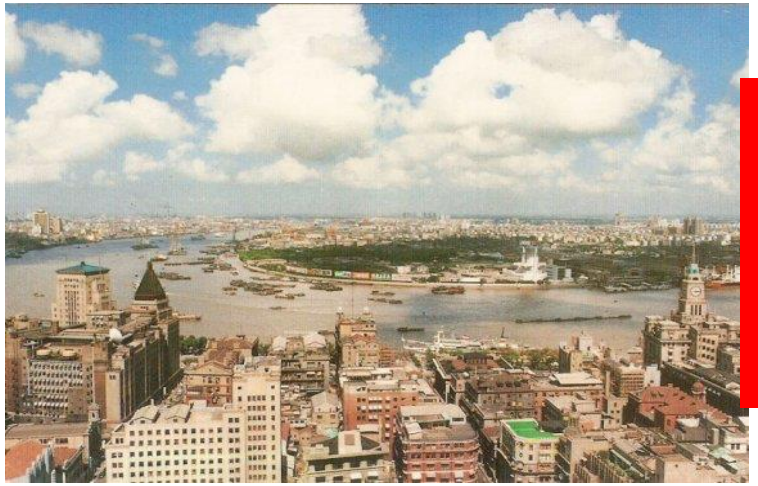
# Natural Catastrophe Exposure Management

# Economic – Urbanisation
# Demographics, Development, Disasters

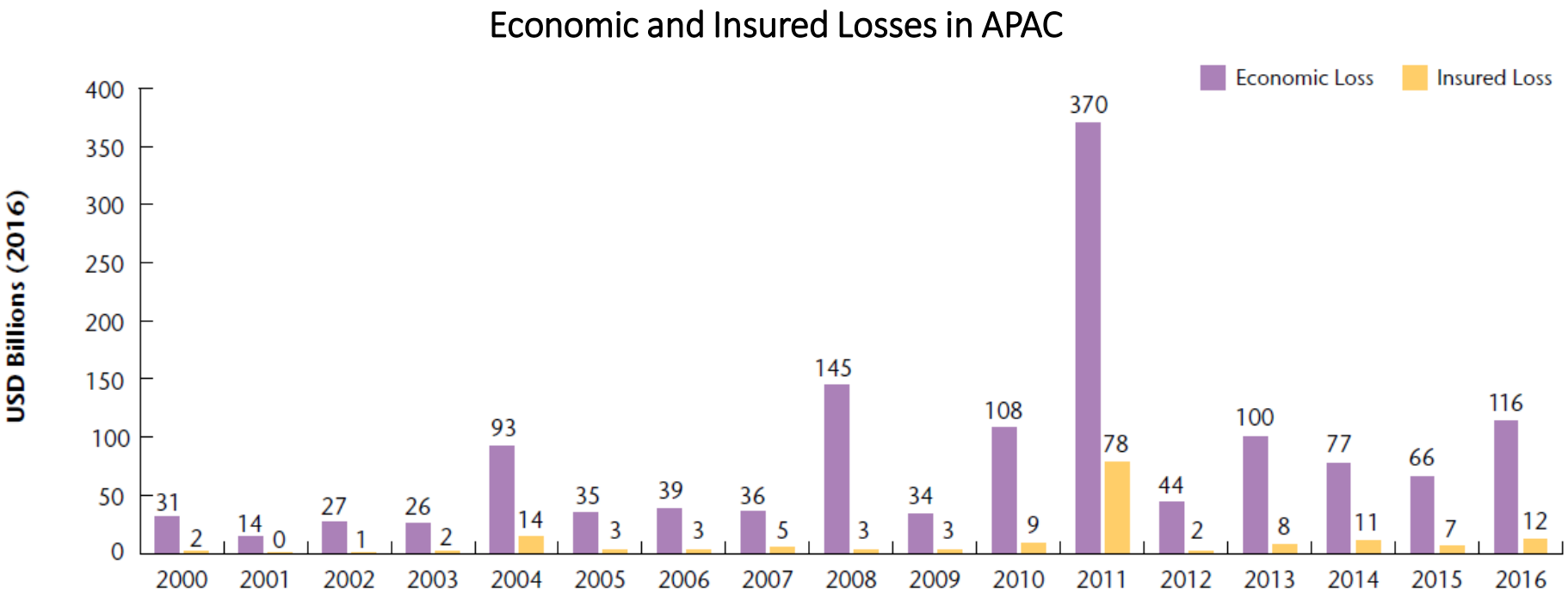


Shanghai
1990
to
2012

- Asia constitutes about 55 percent of the world's urban population.
- By 2026, the population of Asia is expected to be more than 50 percent urban.
- More than half of the world's mega-cities (13 out of 22) are now found in Asia and the Pacific.

# APAC Economic and Insured Losses

- In 2016 Percentage of Catastrophe losses insured by regions
  - **APAC just over 10%**
  - USA more than 51% and in the Americas 35% (largely due to Canada)
  - EMEA around 31%



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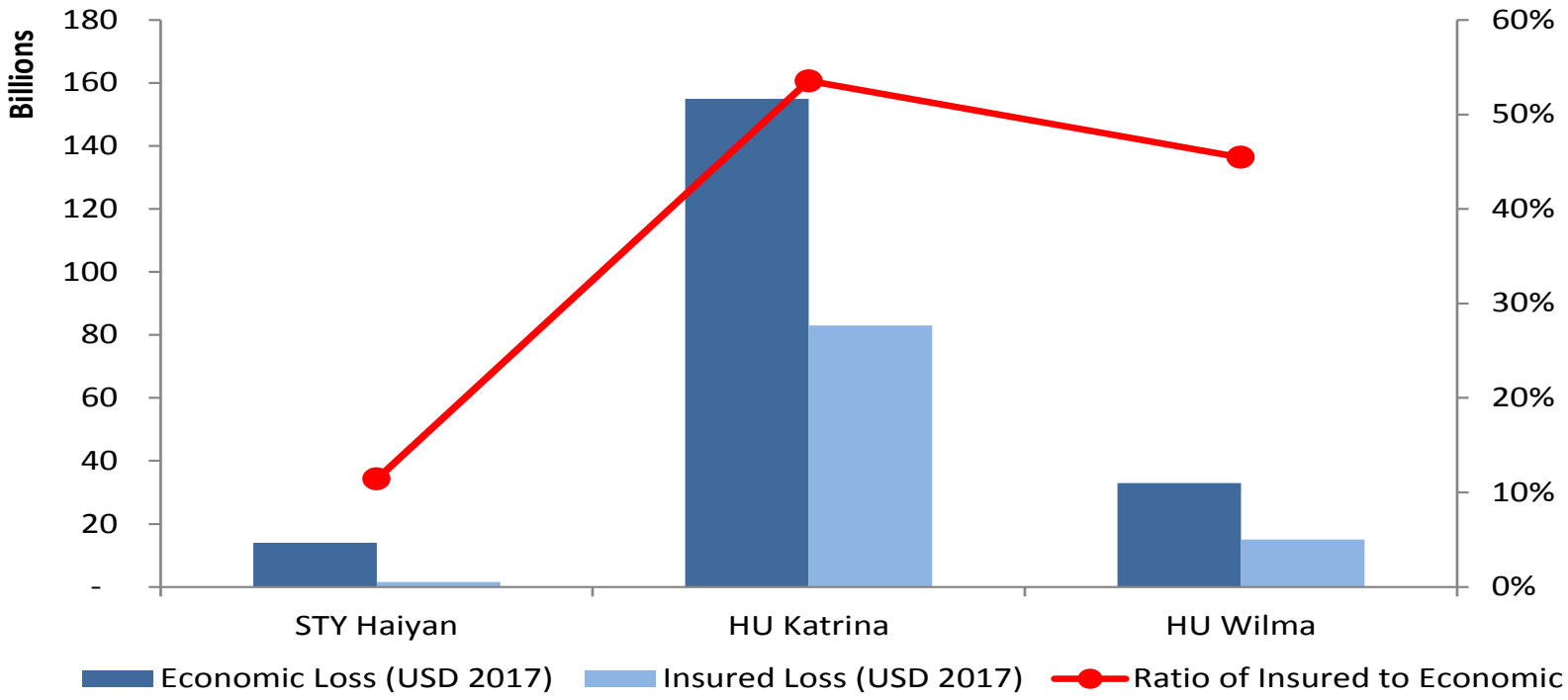
# APAC Economic and Insured Losses

- **Super Typhoon Haiyan** (in 2013) is the largest tropical storm event to make landfall on record globally.
- Insured loss was around 10% of economic. Close to half of the insured loss stems from only two risks.



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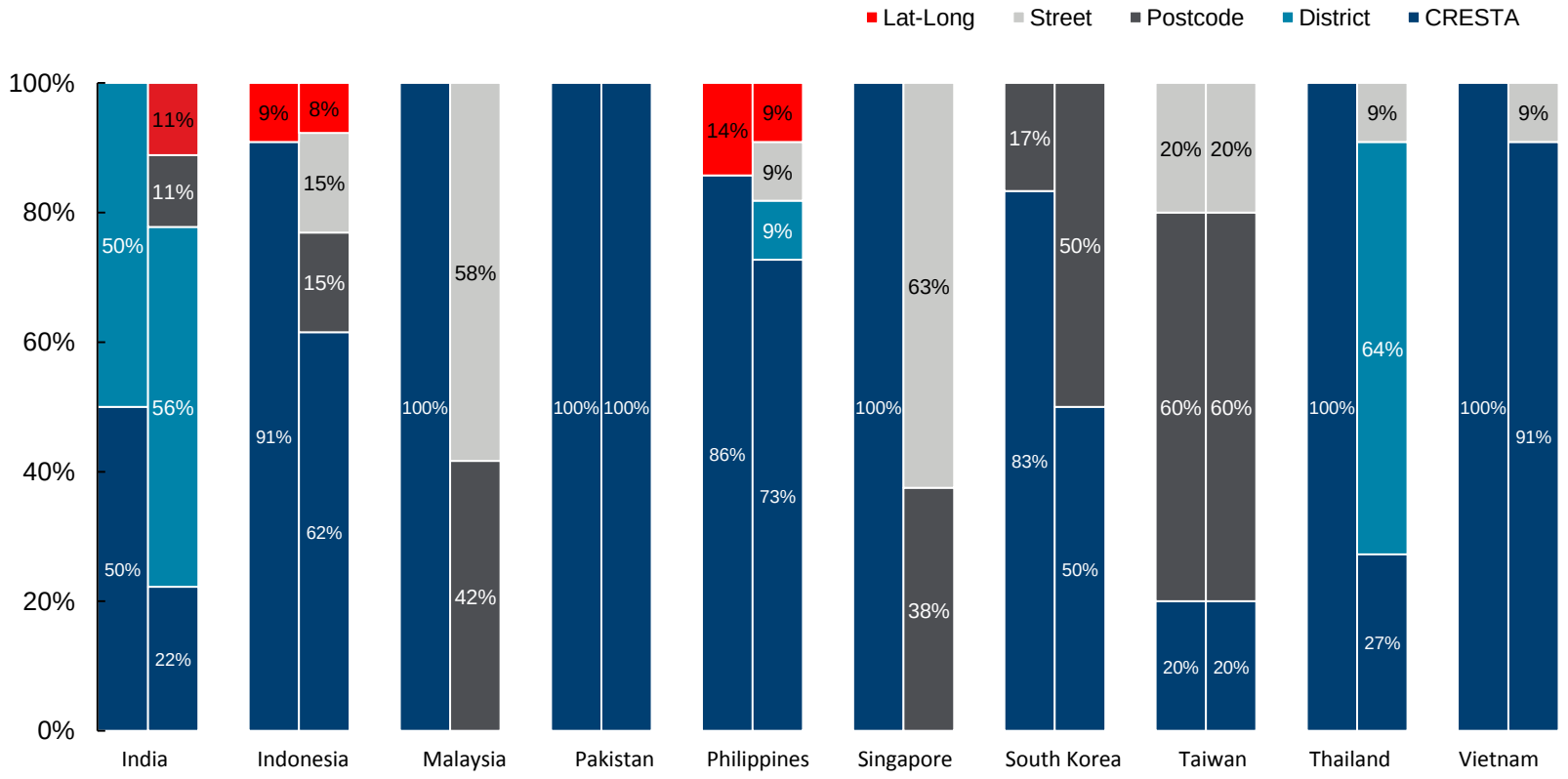
# Comparison of Data Resolution in Asia (over last 5 years)

- Data continues to develop across Asia as the awareness around catastrophe risk and the number and sophistication of catastrophe models continues to grow.



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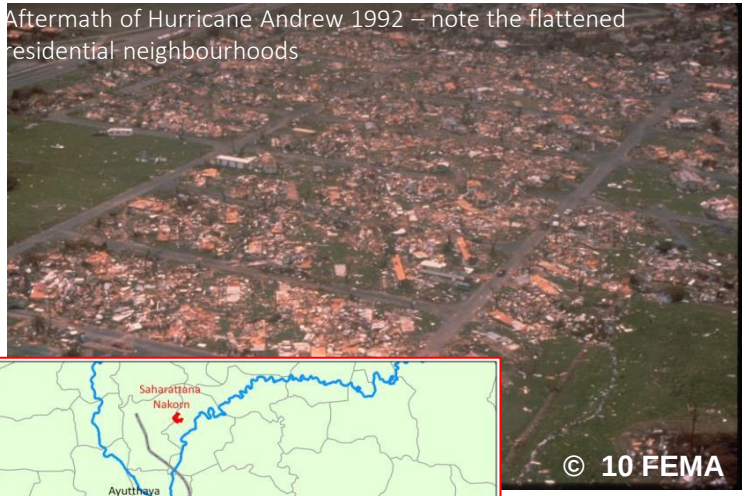
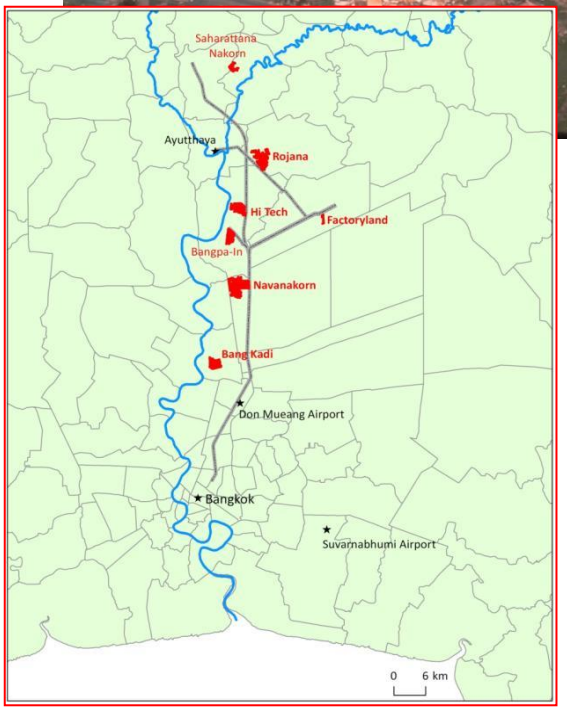
# Challenges in Catastrophe Risk Assessment in Asia

- Nature of typical insured portfolio
  - Smaller portfolios of high valued risks have higher potential for high valued accumulations
- Low insurance penetration, specialist portfolios
- Access to and lack of loss experience
  - Typhoon Haiyan is a typical example
- Access to development data
  - Difficult to access required data - thus reliance on lower resolution or regional data
- Historically US centric development with catastrophe modelling but recently changing with recognition of local needs
- Modelled perils can give rise to large losses
  - Surge, fire following, tsunami etc.
- Exasperated by all points above




Red areas: industrial estates



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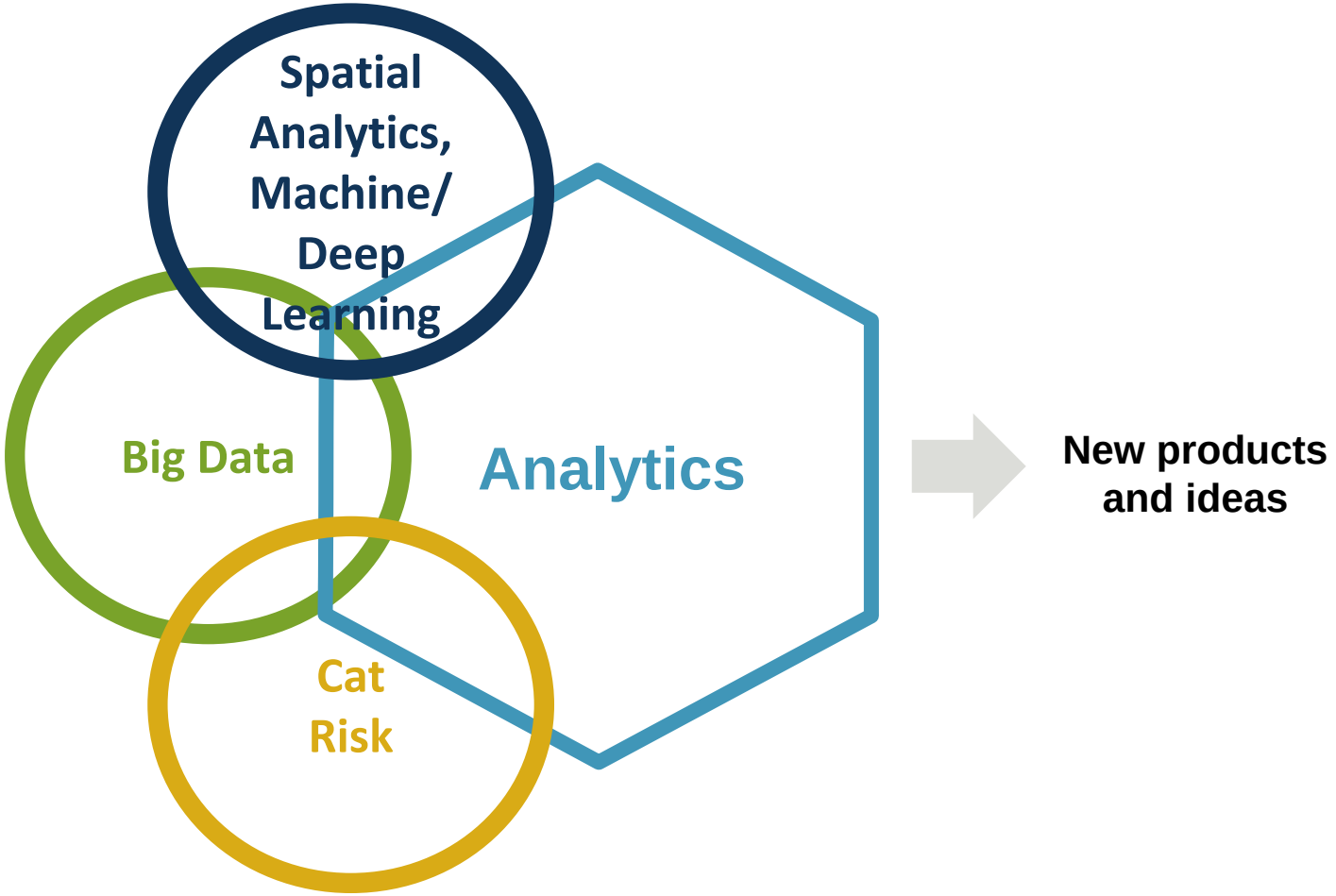
# The Challenge …

… is to improve our understanding of natural catastrophe risk and exposure



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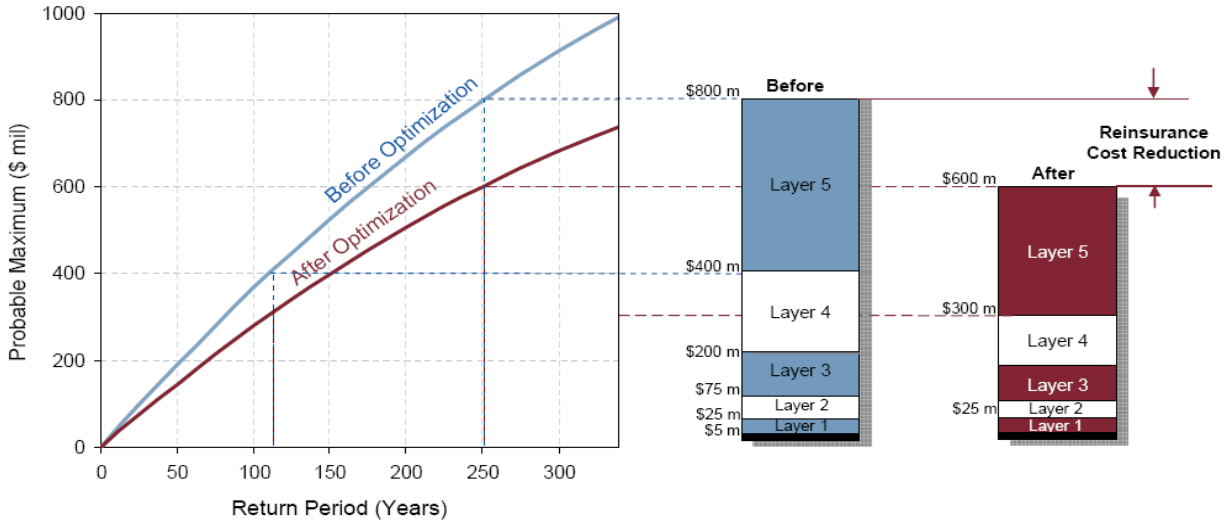
# Natural Catastrophe Exposure Management

Which risks are driving my PML?

# Monitor and Manage Risk Drivers – Dynamic Portfolio Optimisation (DPO)

Perform key loss driver analysis

- Identify policies causing consistently high modelled loss to the portfolio across all modelled events
- Aon Benfield offers **Dynamic Portfolio Optimisation** (DPO) for this purpose
- An analytic process that improves the risk-reward relationship of an insurer's catastrophe portfolio




- Identify policies to remove for the best ratio of Premium to modelled loss across the entire modelled event set
- Requires risk-level exposure data



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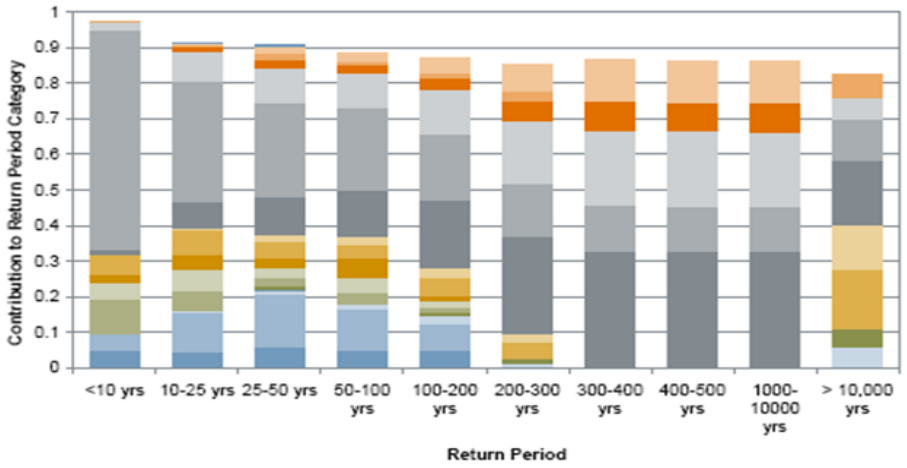
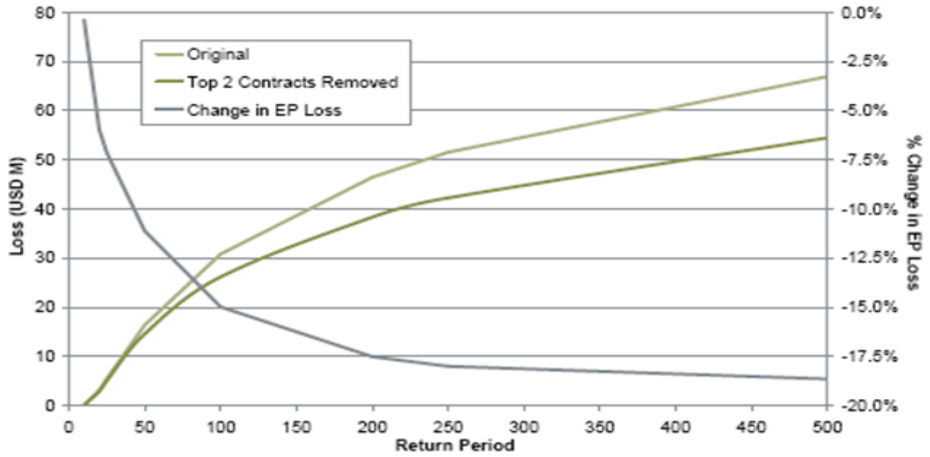
# DPO Application




Identify Key contributing policies relative to premium for return period of interest

Assess impact of policy removal



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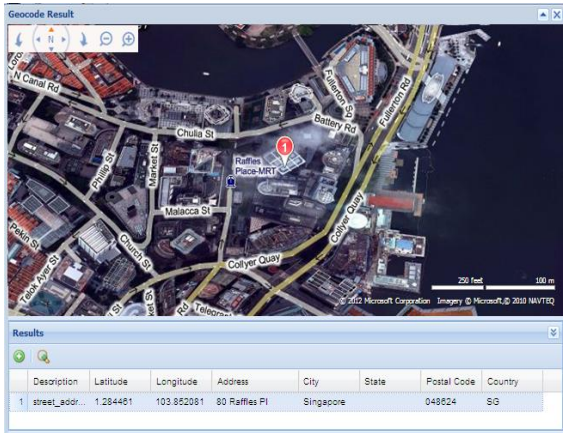
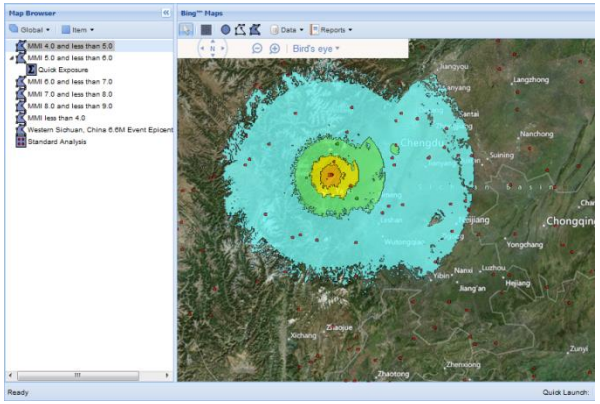
# Natural Catastrophe Exposure Management

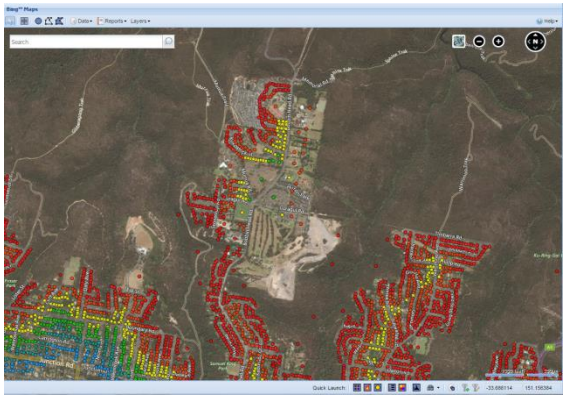
# ImpactOnDemand (IoD)

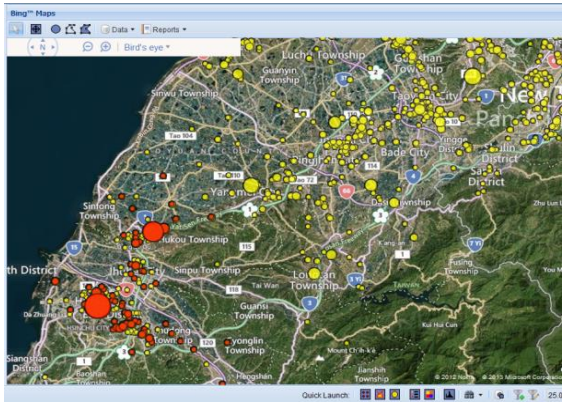
- ImpactOnDemand™ (IoD) is Aon Benfield's innovative and versatile platform which enables you as our client to visualize and quantify exposures to risk, in addition to performing detailed data analysis to drive insightful business decisions.

- The tool assists in:
  1. Exposure monitoring and information
  2. Identifying exposure accumulations
  3. Individual risk mapping and underwriting
  4. Hazard mapping for underwriting and pricing
  5. Claims planning and preparedness
  6. Post-catastrophe analysis





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# ImpactOnDemand - Dataflow


**Client Data**

Property Data, Personal Commercial Auto, Any address with latitude/longitude

**Industry Data**

**Client Data**





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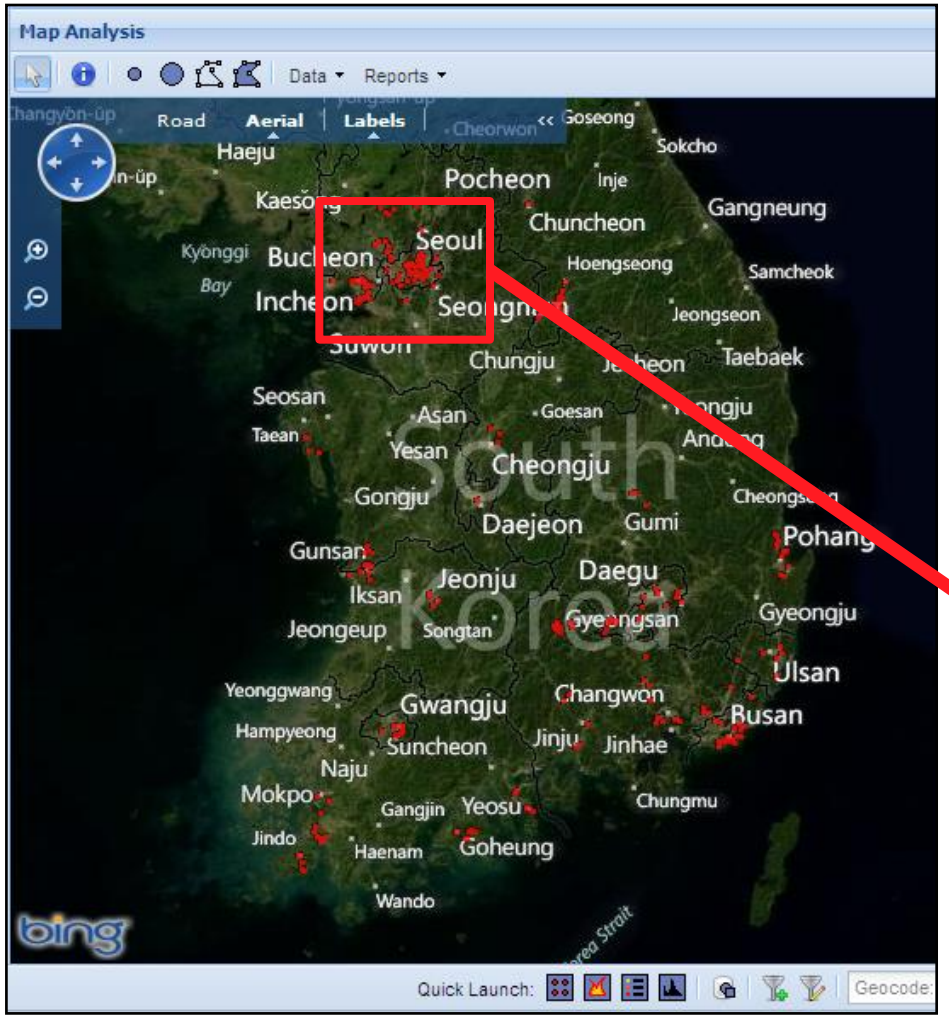
# Natural Catastrophe Exposure Management

How can I visualize and manage exposures?

# Identifying Exposure Accumulations




The tool links between your information and catastrophe risk.

It allows you to visually point out areas of risk concentration.

Use spatial analysis techniques

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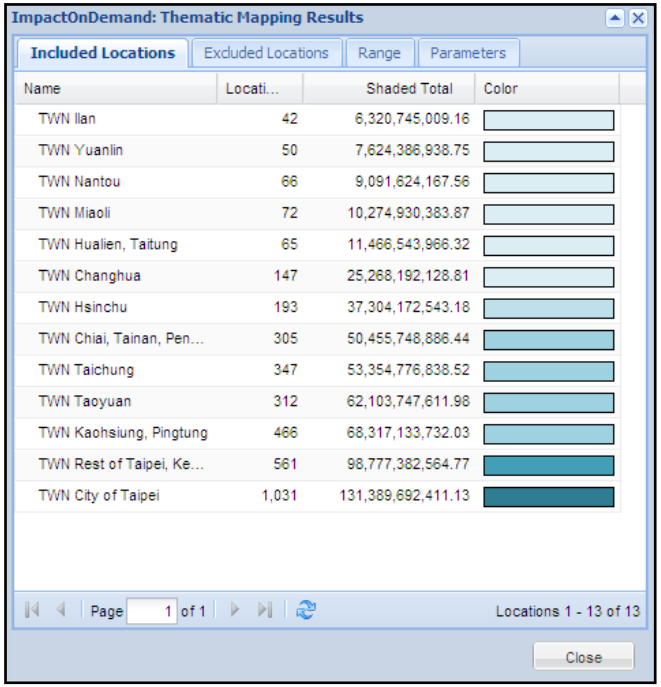
# Identifying Exposure Accumulations – Thematic Mapping

Thematic Mapping lets you visualize your portfolio based on a specific criteria. This functionality will let you identify regional differences in your portfolio.


Thematic Mapping by CRESTA in terms of the Total Sum Insured.



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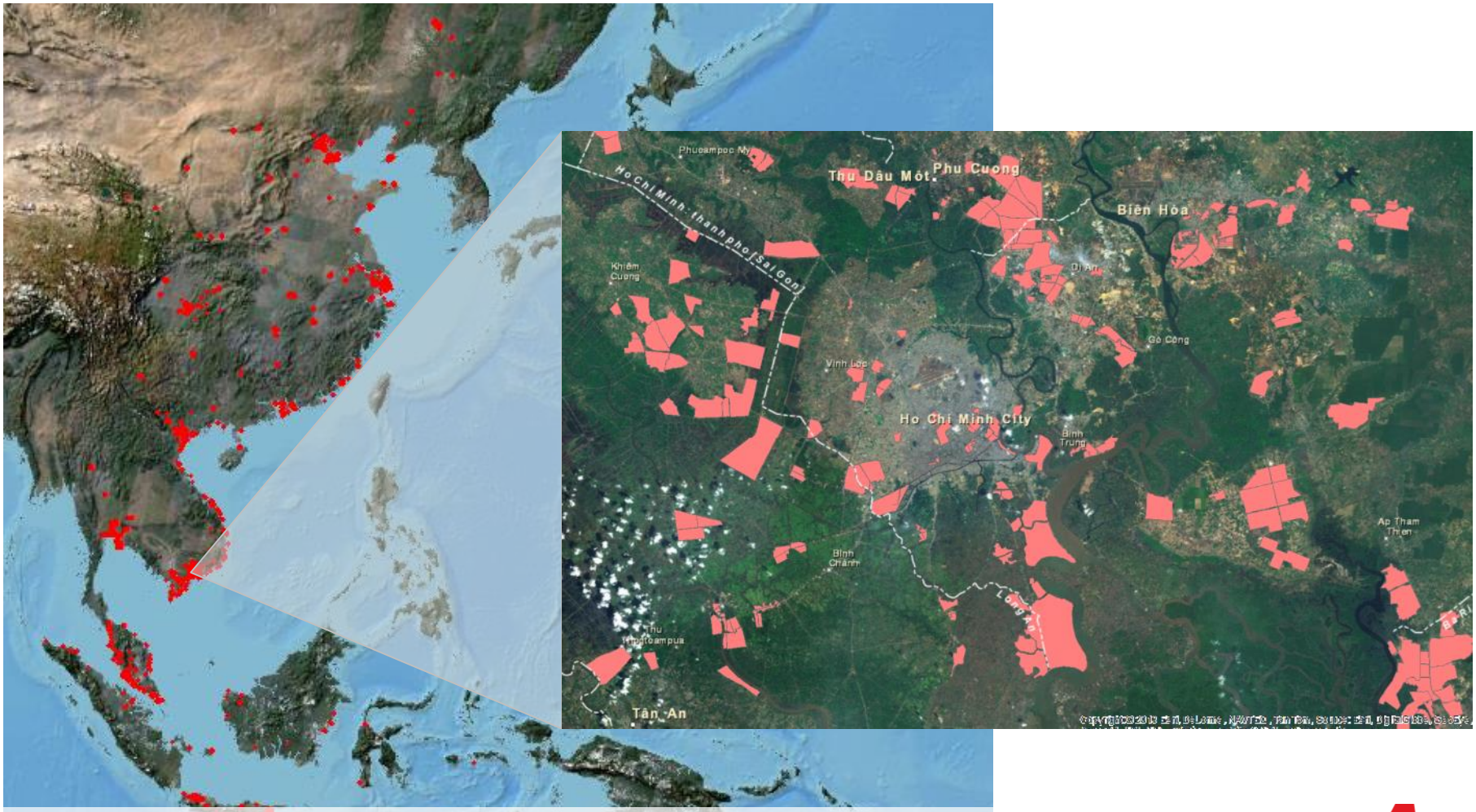
# Industrial Estates Database: Consideration for High Value Risk Accumulation

Current and future expansion of Industrial Estates important to Asia risk landscape




**Over 2, 0 Industrial Estates covering 13 territories in Asia**



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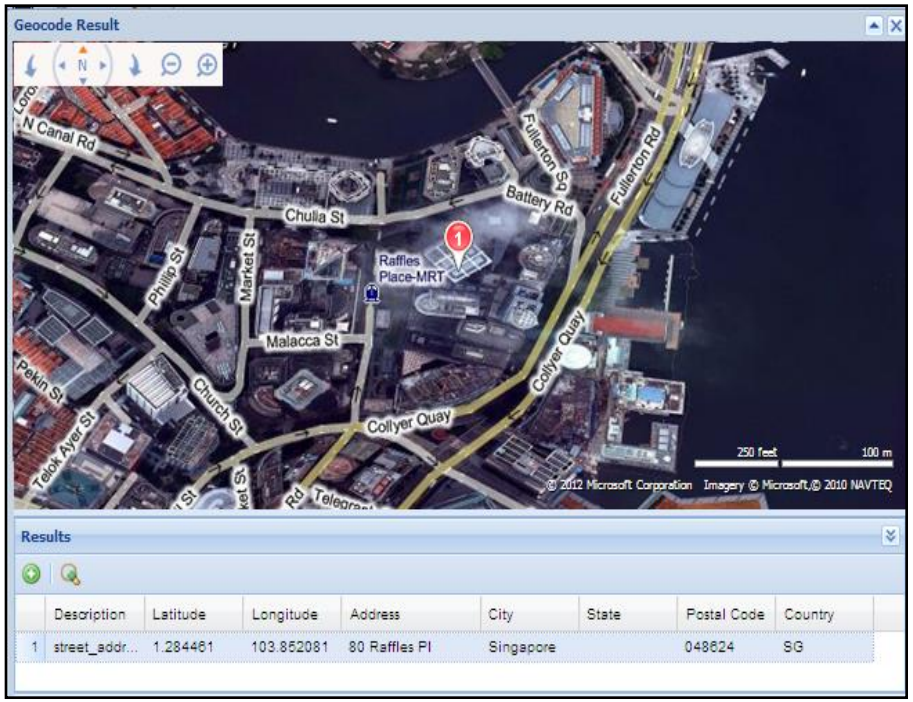
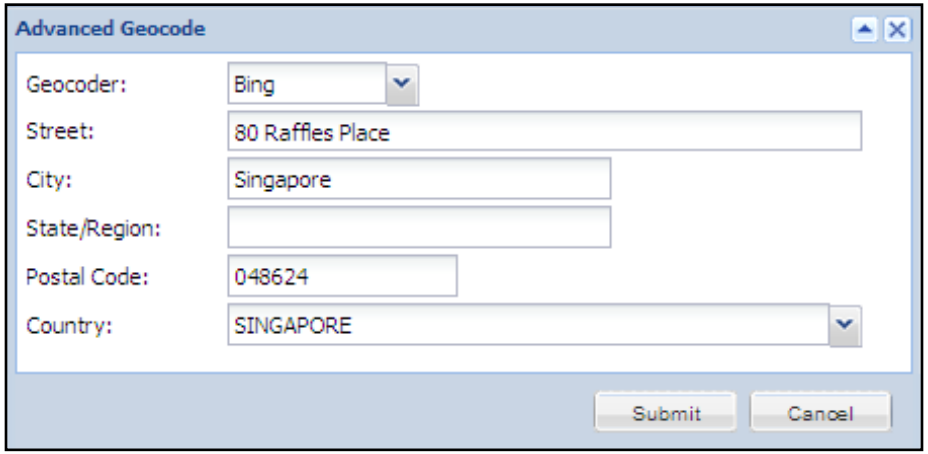
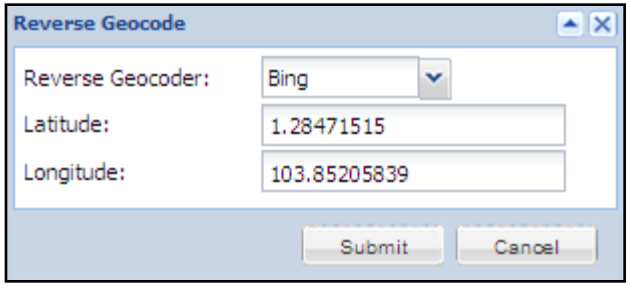
# Individual Risk Mapping and Underwriting




For a new risk, ImpactOnDemand has the ability to geocode and locate this risk using any of the four available geocoding engines (Bing, Google, Yahoo or Pitney Bowes).

With the use of detailed satellite imagery available within IoD, the surrounding area around this location can easily be visualized.



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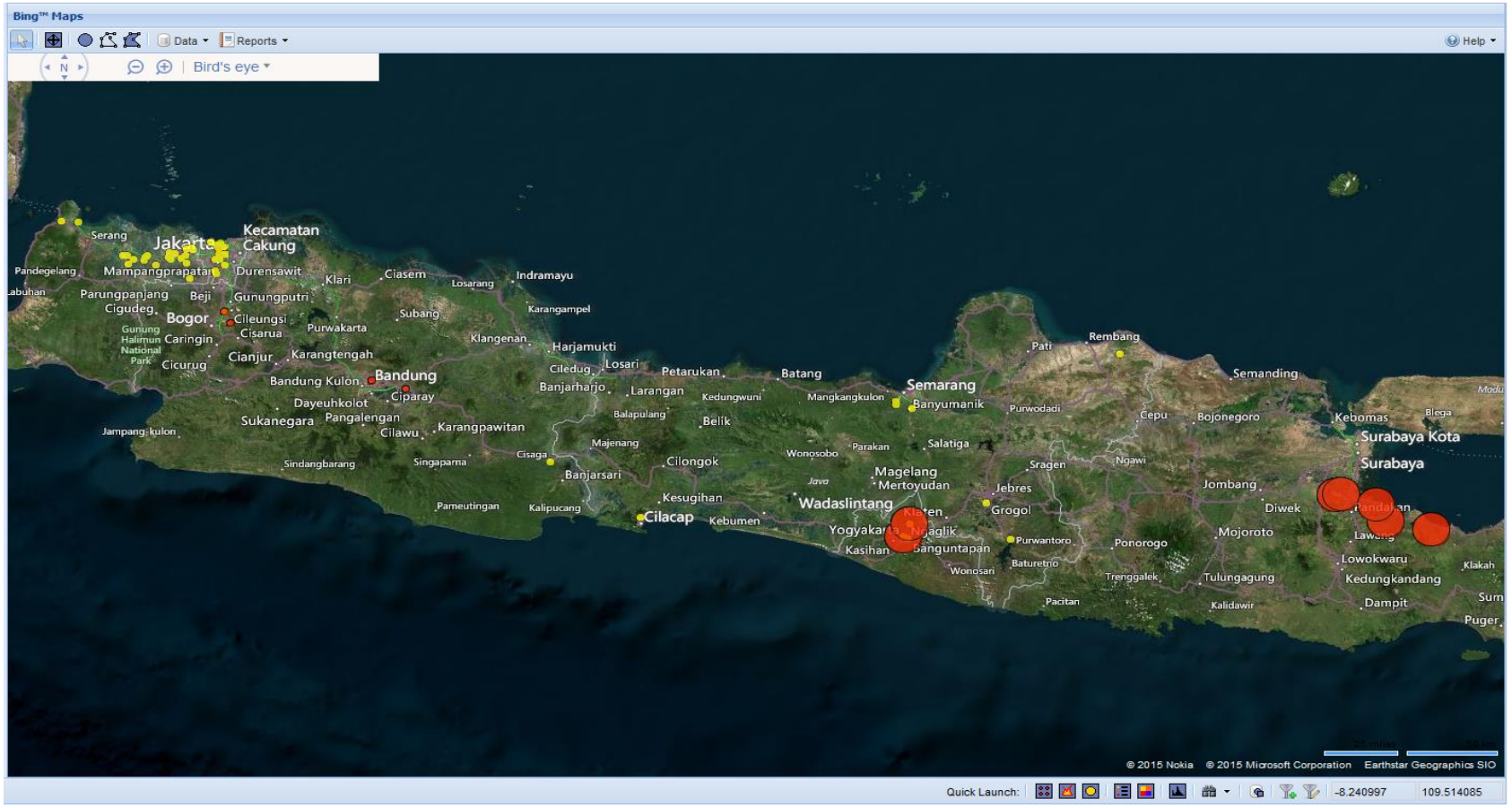
# Custom Risk Analysis and Visualisation

E.g. - Show me Industrial Estates within x km of a volcano and scale by earthquake risk



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# Natural Catastrophe Exposure Management

How can I prepare and plan for claims?

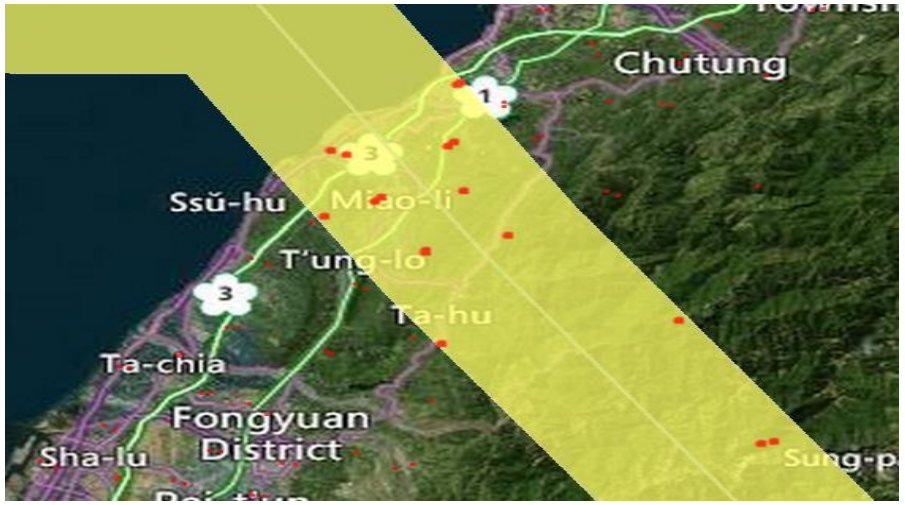
# Claims Planning and Preparedness


One feature of ImpactOnDemand™ is the ability to use shapes within the Shape Library to display historical and real-time events.

Useful for claims management and analysing catastrophe prone risks.

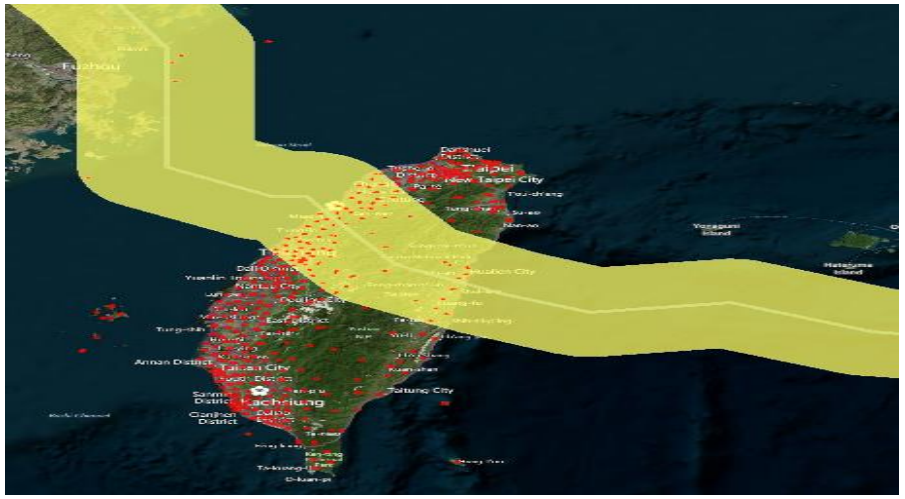
- Estimate number of claims before an event occurs

# Claims Planning and Preparedness




Create 10 km buffer around Typhoon Morakot, which struck Taiwan in 2009

This buffer can then be intersected to your portfolio of risks.



The same event with 50 km buffer



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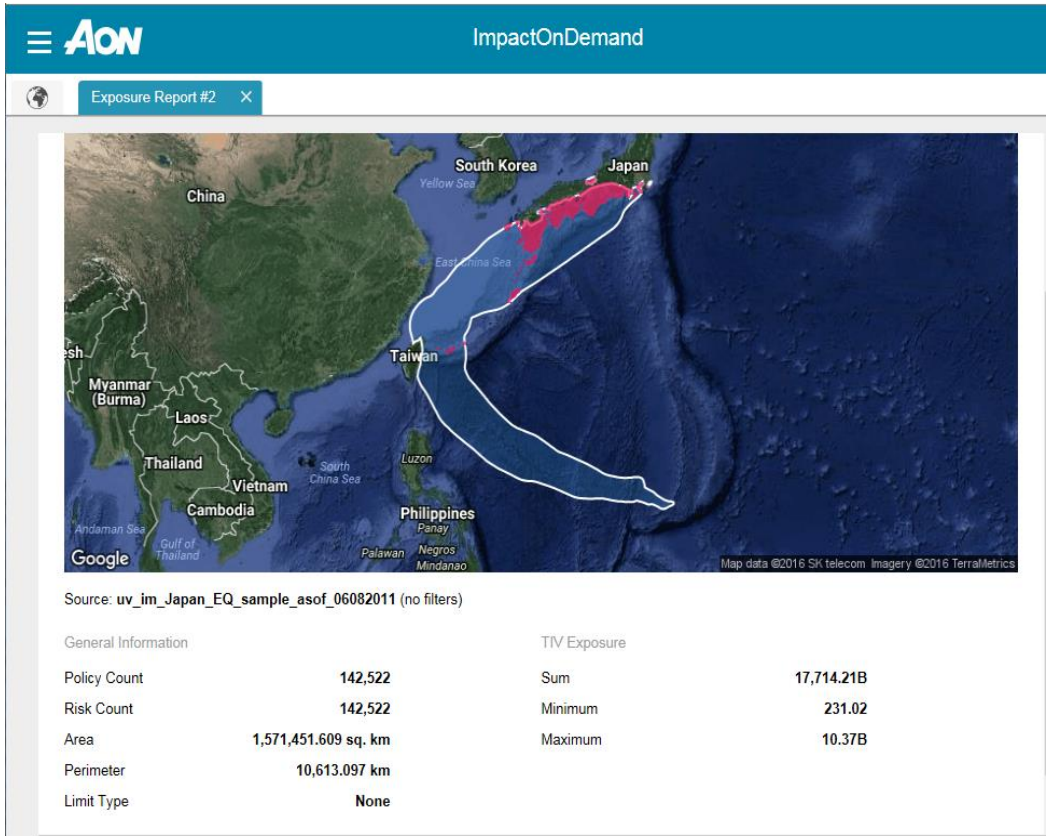
# Claims Planning and Preparedness




A Quick Exposure Report showing the intersection of Typhoon Malakas sustained wind history with a sample Japan risk portfolio.

The report shows **142,522** policies are affected, with a total insured value of **17,714.21B** Yen . It also shows the minimum and maximum location insured values.

# Natural Catastrophe Exposure Management

How can I assess/rate individual risks or locations?

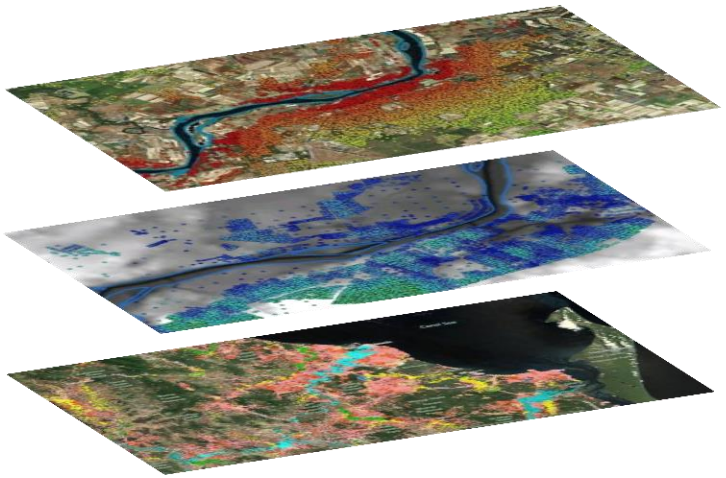
# Integrating Risk Awareness: CHIP example

CHIP: Combined Hazard Information Platform

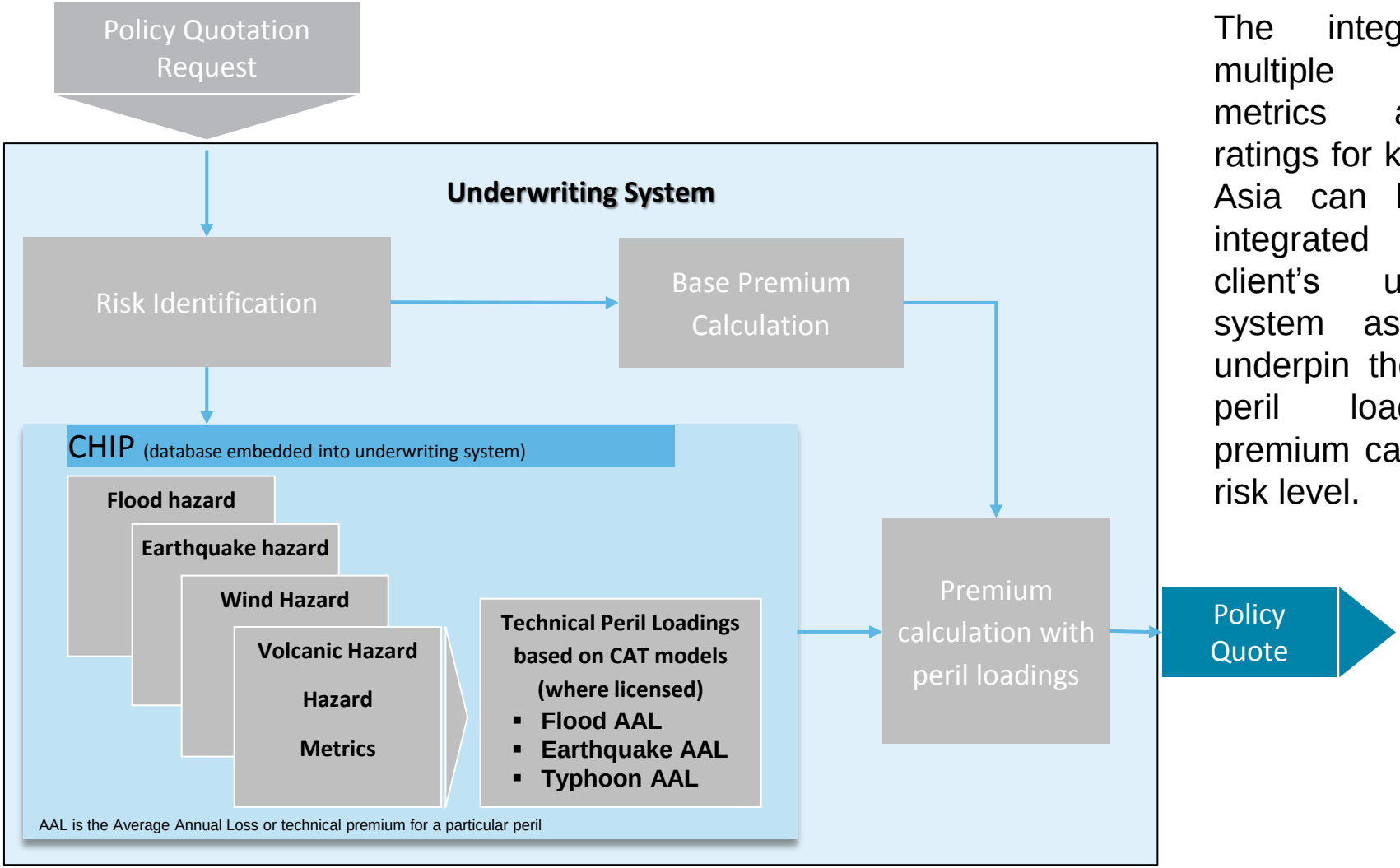
- Recent loss history from multiple perils has given rise for more technical based pricing
- Companies may not have access to catastrophe models or tools to assist in estimating relevant catastrophe loads.
  - Vendor license restrictions for reinsurance broker also impede this application.
- Robust technical pricing need to consider more frequent events as well for which may not be modelled or understood, like flood
- Direct Underwriting Support

**Hazard attributes - modelled**
(i.e. flood, earthquake, cyclone)

**Physical attributes related to hazard**
(i.e. distance from river, height, coastal exposure)



# CHIP: Underwriting Concept




The integration of multiple hazard metrics and risk ratings for key perils in Asia can be directly integrated into a client's underwriting system as well as underpin the technical peril loading for premium calculation at risk level.



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# CHIP Asia: Vietnam


| | | | |
|---|---|---|---|
| **Park Name** | Quang_minh 2 | **Country** | Vietnam |
| **Address** | Me Linh District, Ha Noi Capital, Vietnam | | |
| **Latitude** | 21.193893 | **Longitude** | 105.76227 |
| **Estate Age** | 2003 | **Area (sqkm)** | 0.04416 |
| **Number of Factories** | | **Development Agency** | Vietnam Investment Development Group (VID) |
| **Dominant Industry** | mechanical industry, electronic industry, processing food, consumers goods, jewelry, parts of motorbike, automobiles and electrical appliances | | |

**EARTHQUAKE**

| | |
|---|---|
| PGA (m/s2) | 0.2350 |
| EQ RISK RATE | **LOW** |

**TYPHOON**

| | |
|---|---|
| DISTANCE TO COAST (km) | 92.65 |
| 100 Yr Wind Speed (km/h) | 169.49 |
| Storm Surge Risk Rate | VERY LOW |
| TY RISK RATE | **LOW** |

**FLOOD**

| | |
|---|---|
| 50 Year Flood Depth (m) | 0.13 |
| 100 Year Flood Depth (m) | 0.15 |
| 250 Year Flood Depth (m) | 0.17 |
| Distance to Watercourse (km) | - |
| Hanoi 2008 Flood Depth (m) | - |
| FL RISK RATE | **HIGH** |

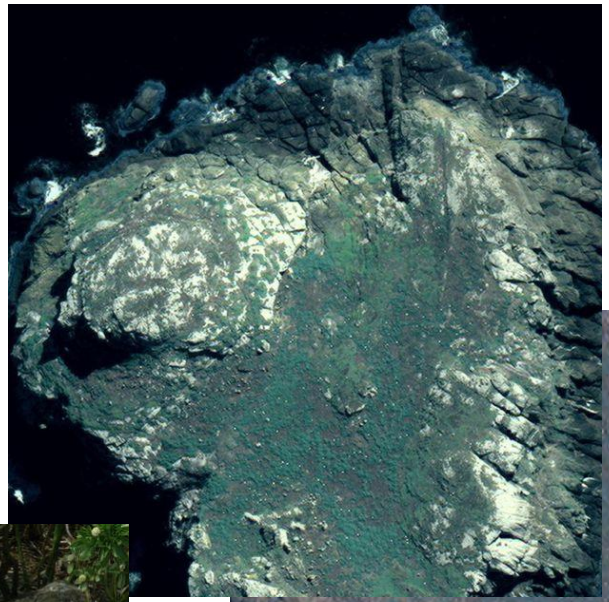
# Natural Catastrophe Exposure Management

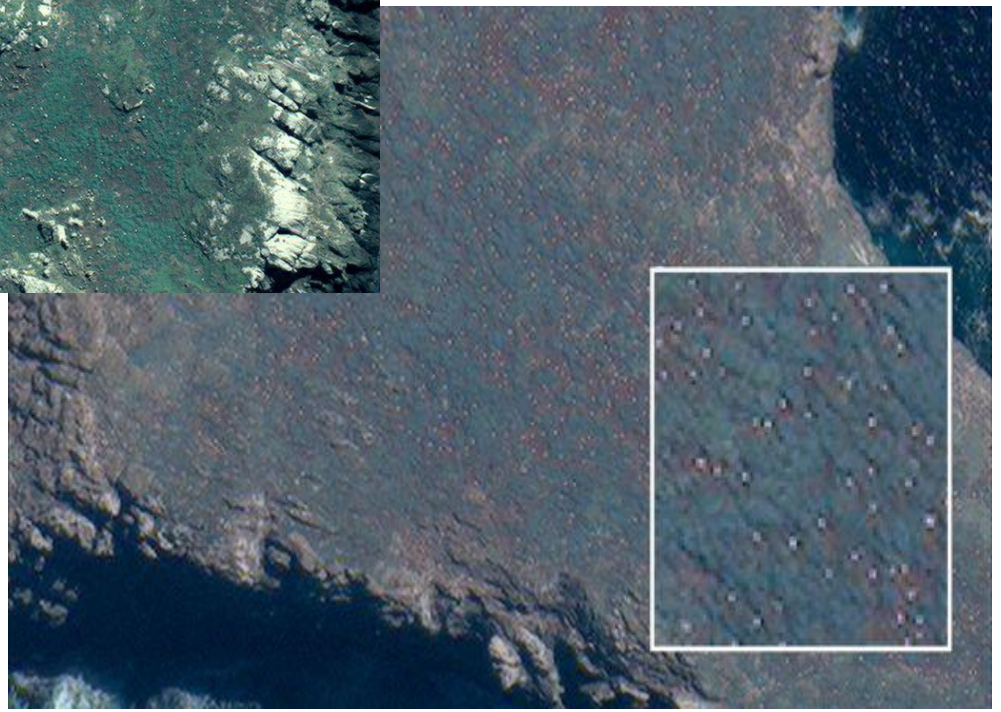
How to improve understanding of Cat risks and accuracy of Cat Models?

# Counting Albatrosses..

Northern Royal Albatrosses in Chatham Islands, New Zealand

Count an entire population of any species from orbit for the first time!





Source: BBC -http://www.bbc.com/news/science-environment-39797373

# The Challenge with Typhoon Modelling

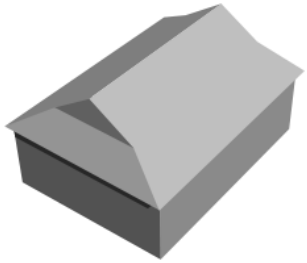
- Building roof is very vulnerable to strong wind caused by a typhoon.
- It is possible to estimate typhoon risk more accurately with information on roof shape/condition.
- However, roof-related information is typically not collected during insurance contract making

Source: The Asahi Shimbun Company

Reference:
Takeshi Okazaki, “Application of Typhoon Model in the Non-Life Insurance Industry”, Wind Engineers, JAWE, 2016, Vol. 41, No. 2, pp. 152-160
https://www.jstage.jst.go.jp/article/jawe/41/2/41_152/_article/-char/ja/

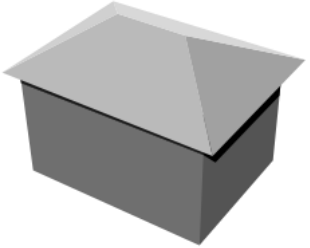
# Roof Shape Classification in Japan

The roof shape in Japan can be mainly classified into the following five types.

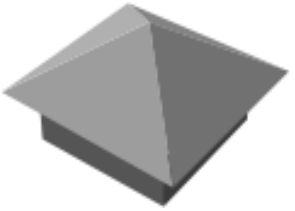


gambrel roof
入母屋屋根

gable roof
切妻屋根



hipped roof
寄棟屋根



square roof
方形屋根

flat roof
陸屋根

Vulnerability to strong wind




AON
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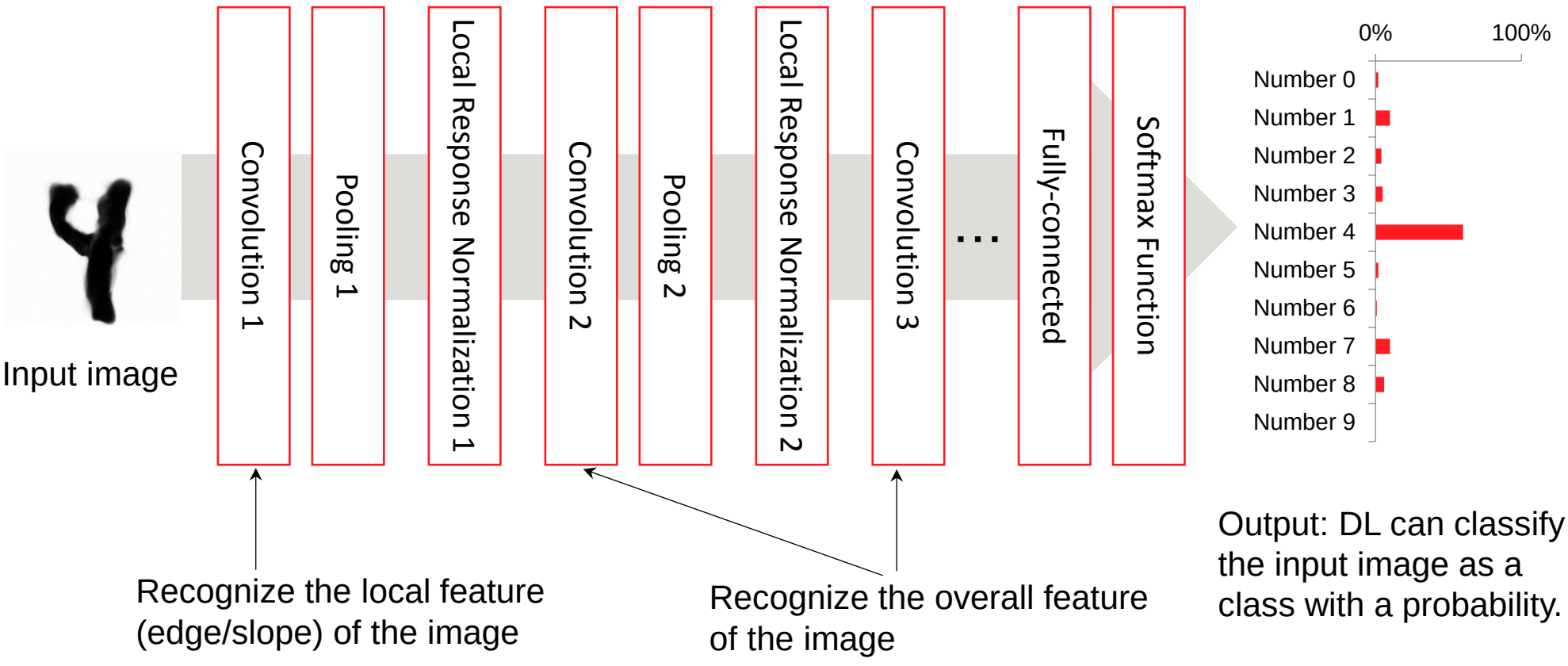
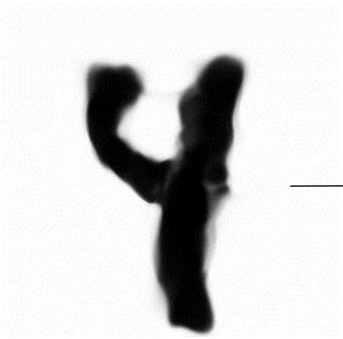
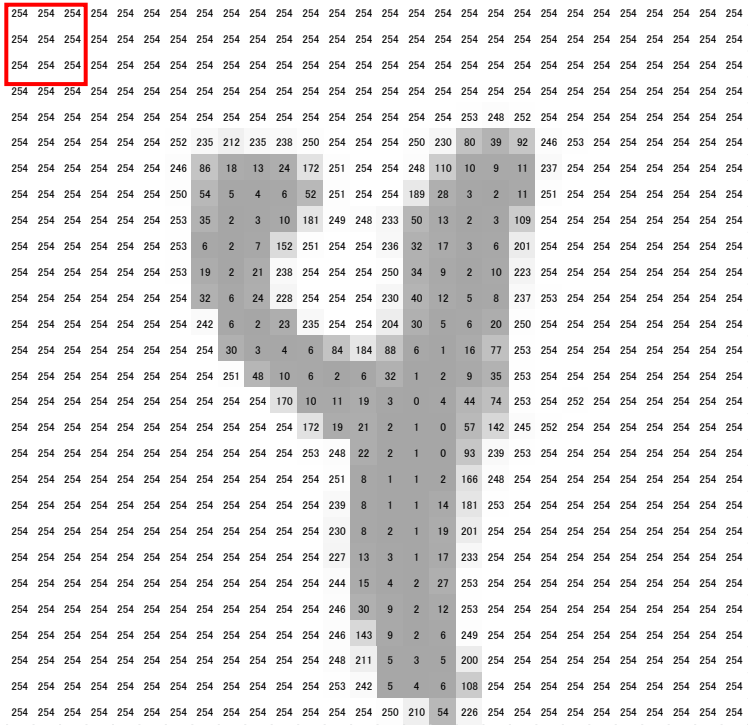
# An Example of the Network of Deep Learning (DL)



# Deep Learning - Convolutional Layer



Input image

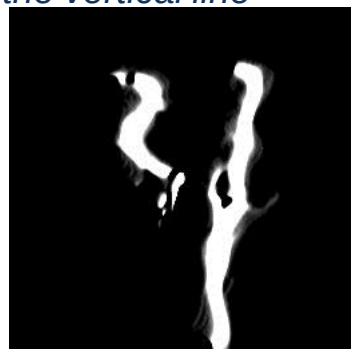


Digital image consists of pixels

*The filter 1 highlights the vertical line*

| | | |
|---|---|---|
| 1 | 0 | −1 |
| 2 | 0 | −2 |
| 1 | 0 | −1 |

Filter 1



*The filter 2 highlights the horizontal line*

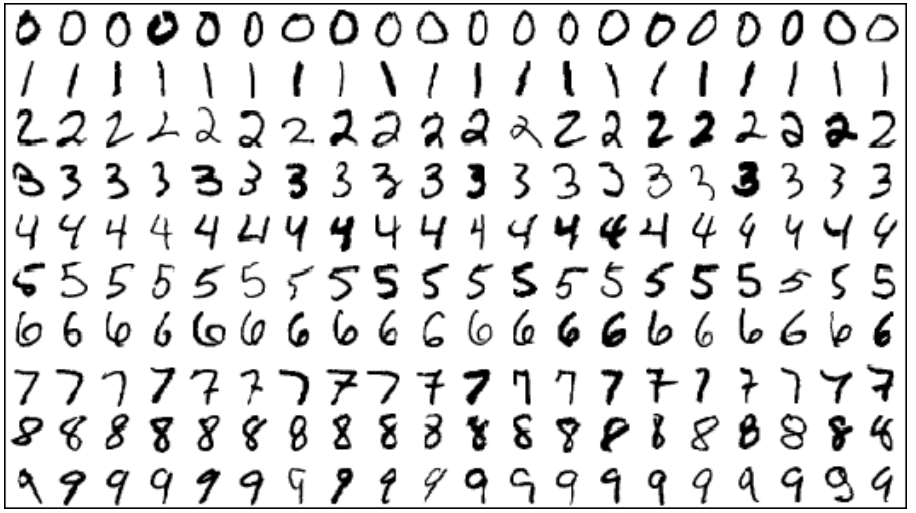
| | | |
|---|---|---|
| 1 | 2 | 1 |
| 0 | 0 | 0 |
| −1 | −2 | −1 |

Filter 2

- A pixel in gray scale shows the value between 0 and 255.
- A convolutional layer is a process of extracting image-features by a filter.
- DL is able to learn the appropriate pattern of the filter automatically.

# Deep Learning - Test Case

- The MNIST database of handwritten digits has a training set of 60,000 examples, and a test set of 10,000 examples.
- The digits have been size-normalized and centered in a fixed-size image.



THE MNIST DATABASE of handwritten digits
http://yann.lecun.com/exdb/mnist/

SVM was the traditional best method before deep learning appeared.

| Classifier | Accuracy rate |
|---|---|
| Support Vector Machine (SVM) | 89% |
| Convolutional Neural Network (Deep Learning) | 98% |

# Classify Roof Shape: Learning Process of Deep Learning

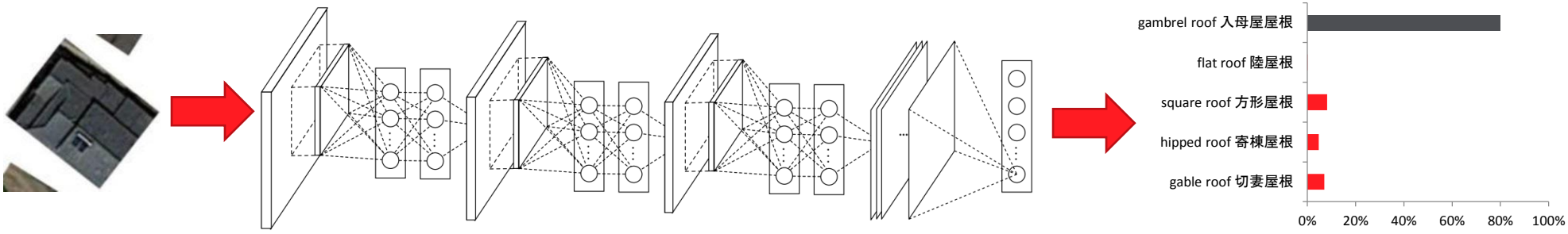
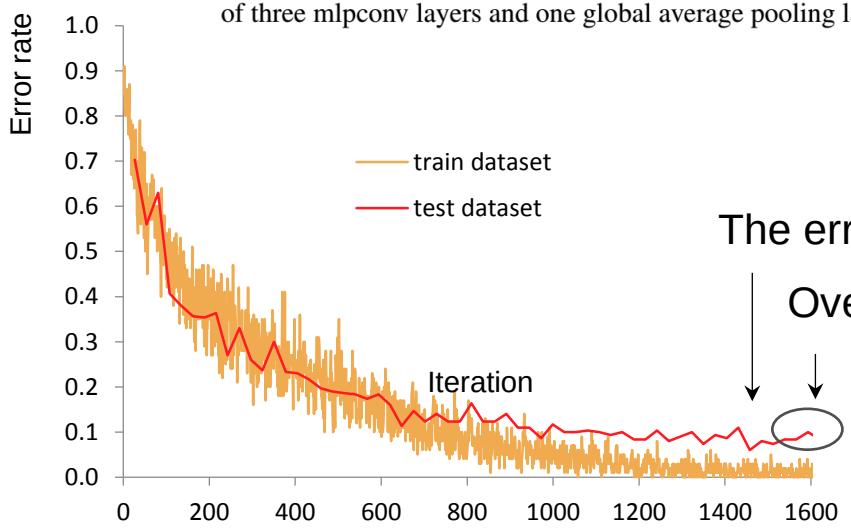



Figure 2: The overall structure of Network In Network. In this paper the NINs include the stacking of three mlpconv layers and one global average pooling layer.




Reference: "Network in Network", M Lin, Q Chen, S Yan, International Conference on Learning Representations

The error rate is 6% (The accuracy rate is 94%)

Overfitting

| Classifier | Accuracy rate |
|---|---|
| Convolutional Neural Network (Deep Learning) | 94-98% |

International patent application applied for in the US



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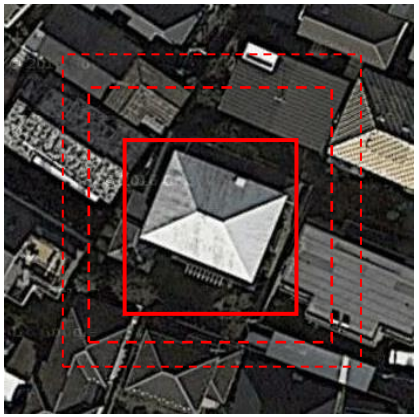
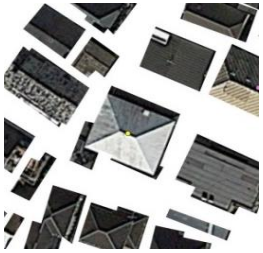
# Classify Roof Shape: Adjusting Input Image

To rotate the image by 90 degrees



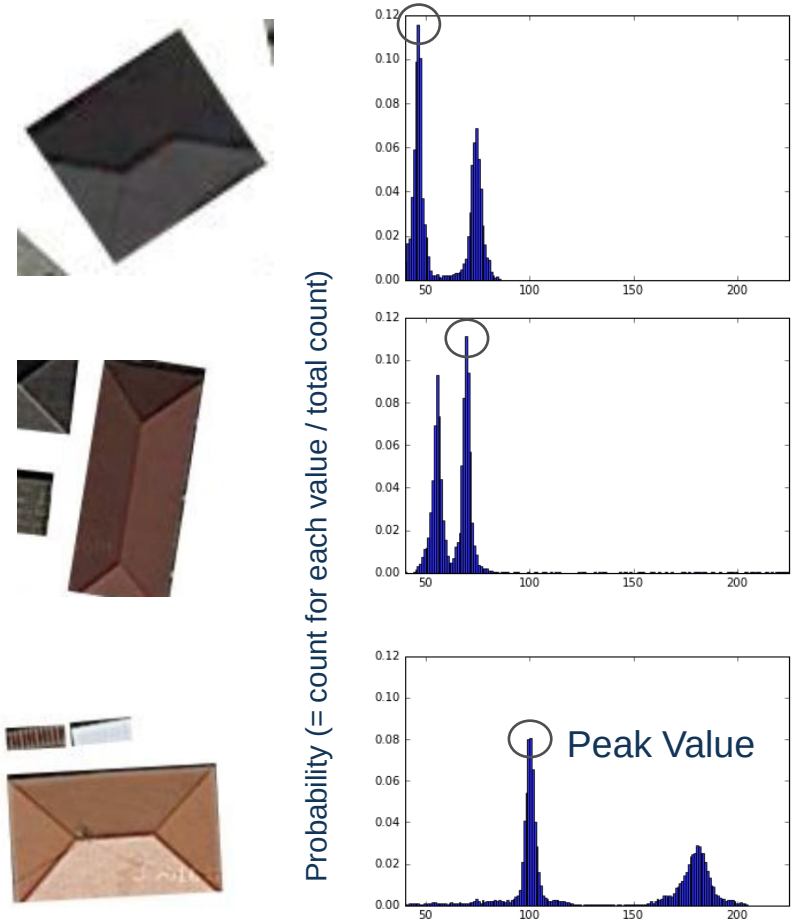
To extract the area that contains only a building



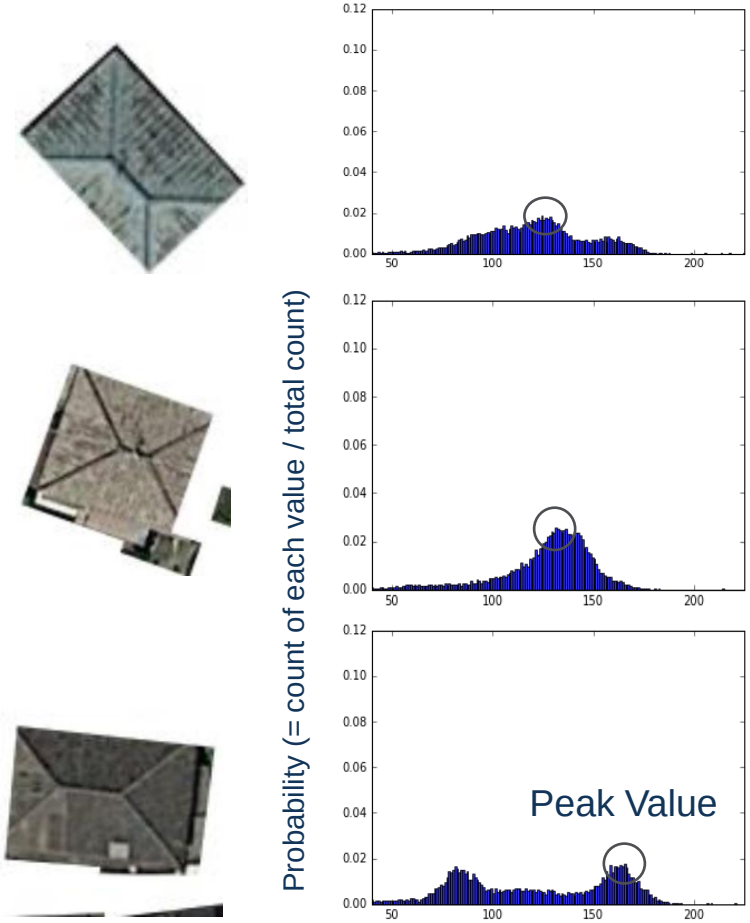
To whiten the background

# Classify Roof Shape: Roof Condition

If a roof is not deteriorated, the peak value of the grey histogram tends to be high/sharp.




If a roof is deteriorated, the peak value of the grey histogram tends to be low/smooth.



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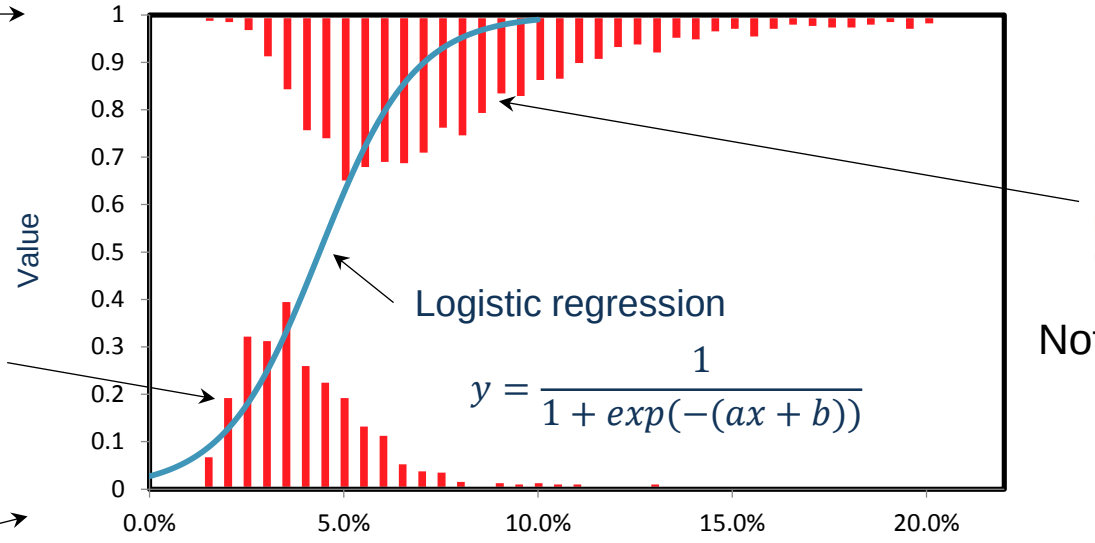
# Classify Roof Shape: Roof Condition (2)

If the roof is not deteriorated, the value assigned is 1.

Deteriorated roof

If the roof is deteriorated, the value assigned is 0.



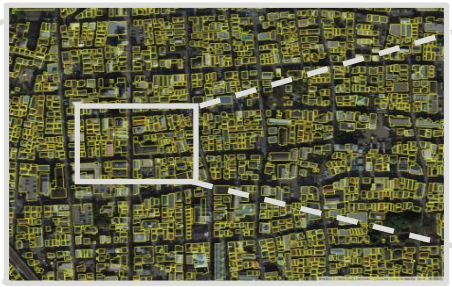

The maximum value of image histogram

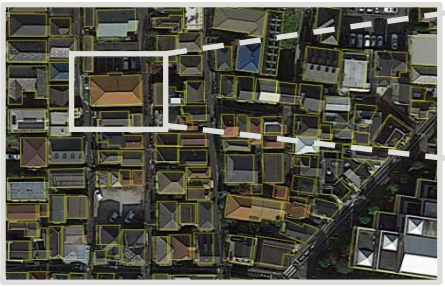
Not deteriorated roof

| Classifier | Accuracy rate |
|---|---|
| The maximum value of image histogram in gray scale | 80 - 85% |

International patent application applied for in the US

# Summary Process of Roof Classification





Input image building by building

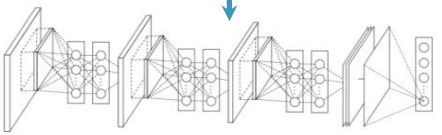
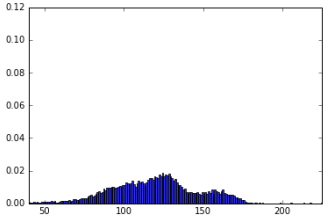


Figure 2: The overall structure of Network In Network. In this paper the NINs include the stacking of three mlpconv layers and one global average pooling layer.

Classify the roof shape using DL




Classify the roof condition by the maximum value of image histogram in grey scale

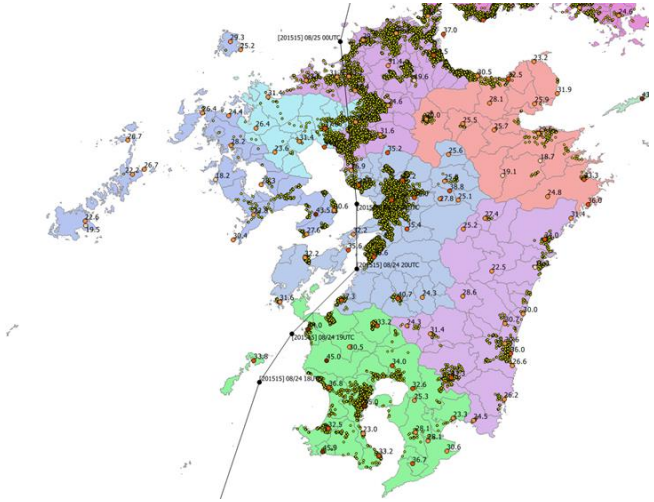
GPU processing

- Achieved a building coverage ratio of 100% for the whole Japan
- The building database also includes the building area and the coordinates.

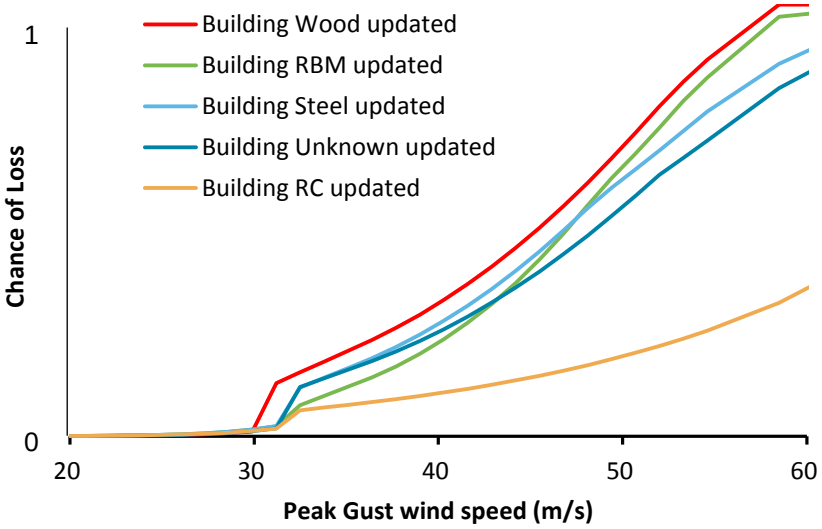

65 million unique buildings

# Updating of Damage Curves

Individual buildings reported claims for Typhoon 15 (95K)



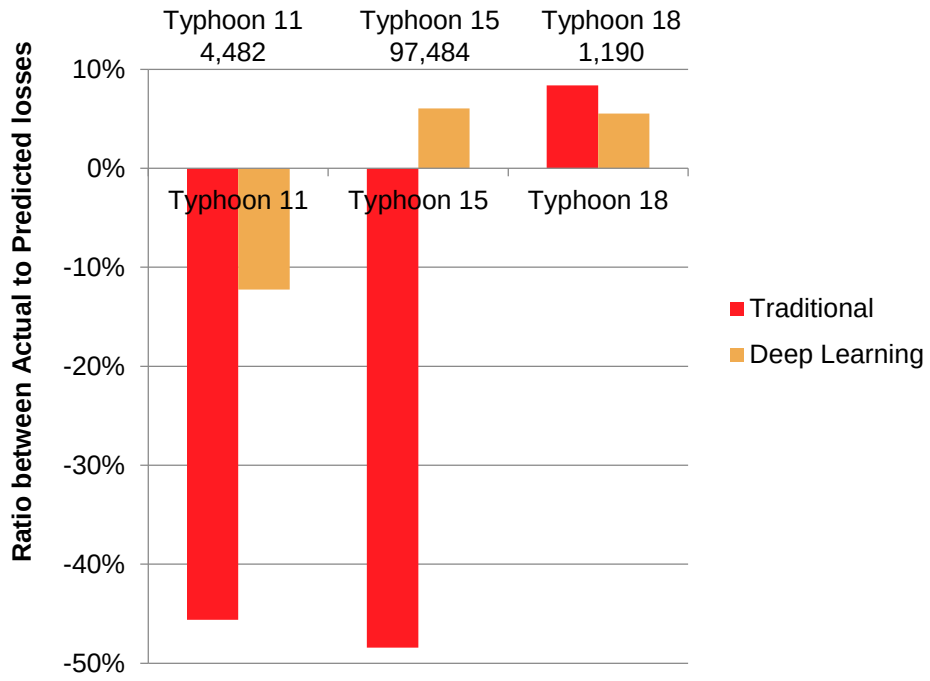
Vulnerability = Chance of Loss + Damage Ratio




- The existing available damage curves were created based on aggregated data (postcode) from 1998 to 2006
- With the DL technique we can study individual buildings and their roof damage to create more accurate vulnerability models based on their Chance of Loss (CoL)
- CoL is the probability of a property being affected by a typhoon or not. Chance of loss is an integral part of damage curves

# Results

- Results using the typhoon damage prediction system were compared to actual payments (as of July 2015).
- Benchmarking was performed for three different typhoons in 2015 and we are now working on 2016 data
- The improvement on damage prediction is substantial for medium to large storms



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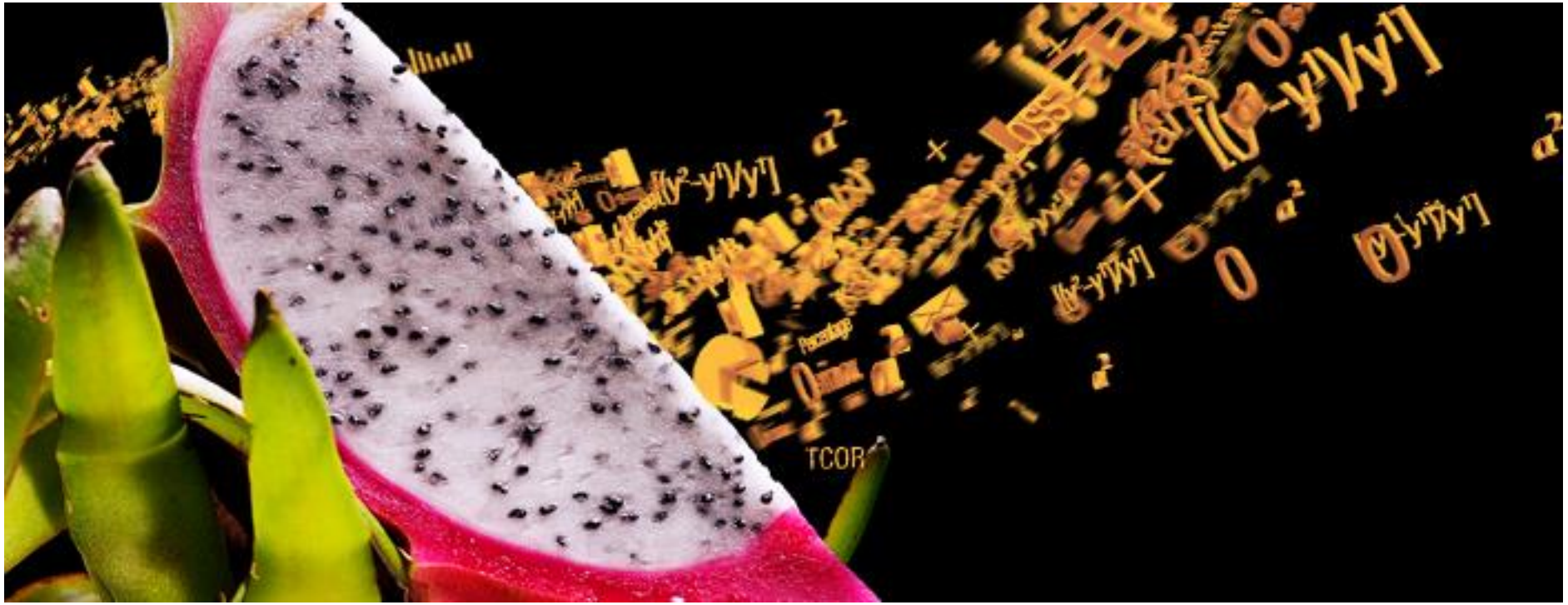


# Consumer Insights and Behavioural Analytics

# Project – Optimisation of Call Centre Operations

- Objective – Improve operational efficiency and achieve cost savings

- Interaction with call centre for annual enrolment of Accident and Health Benefits products
  - Enrolment analytics;
  - Interaction analytics;

- Purchasing/Election/Benefits Optimization
  - Choice analysis;

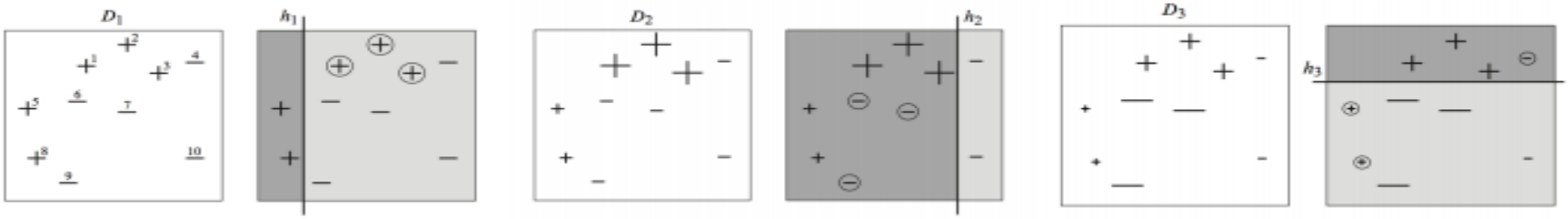
# Data Analytics Pipeline

## Problem Statement

**Data Source** → **Data Exploration** → **Data Preparation** → **Model Generation** → **Visualization** → **Sharing Insights**

- **Data Source**
  - Demographics
  - Enrolment
  - Interaction
  - Customer Satisfaction
- **Data Exploration**
  - Frequency distribution
  - Missing values
  - Outliers
  - Correlation
- **Data Preparation**
  - Sampling;
  - Feature selection and engineering
- **Model Generation**
  - R/H2o/ Sparkling Water
  - RF
  - GBM
  - GLM
- **Visualization**
  - Operational dashboard;
  - Visualization of drivers
- **Sharing Insights**
  - Sharing insights with stakeholders

# Gradient Booster Model (GBM)




- GBM is a machine learning technique typically used for regression and classification problems.

- **Gradient Boosting = Gradient Descent + Boosting**

- Gradient boosting involves three elements:
  - A loss function to be optimized.
  - A weak learner to make predictions.
  - An additive model to add weak learners to minimize the loss function.

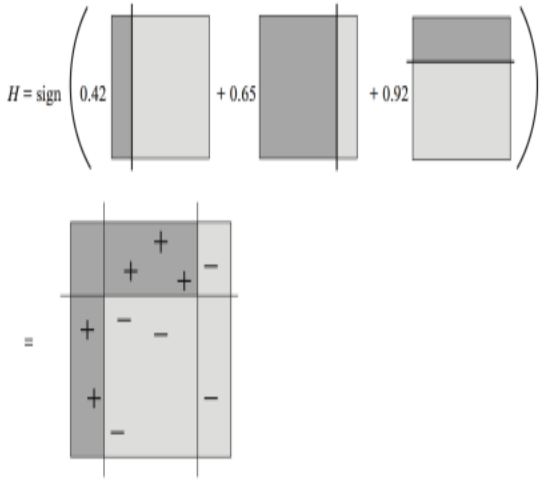
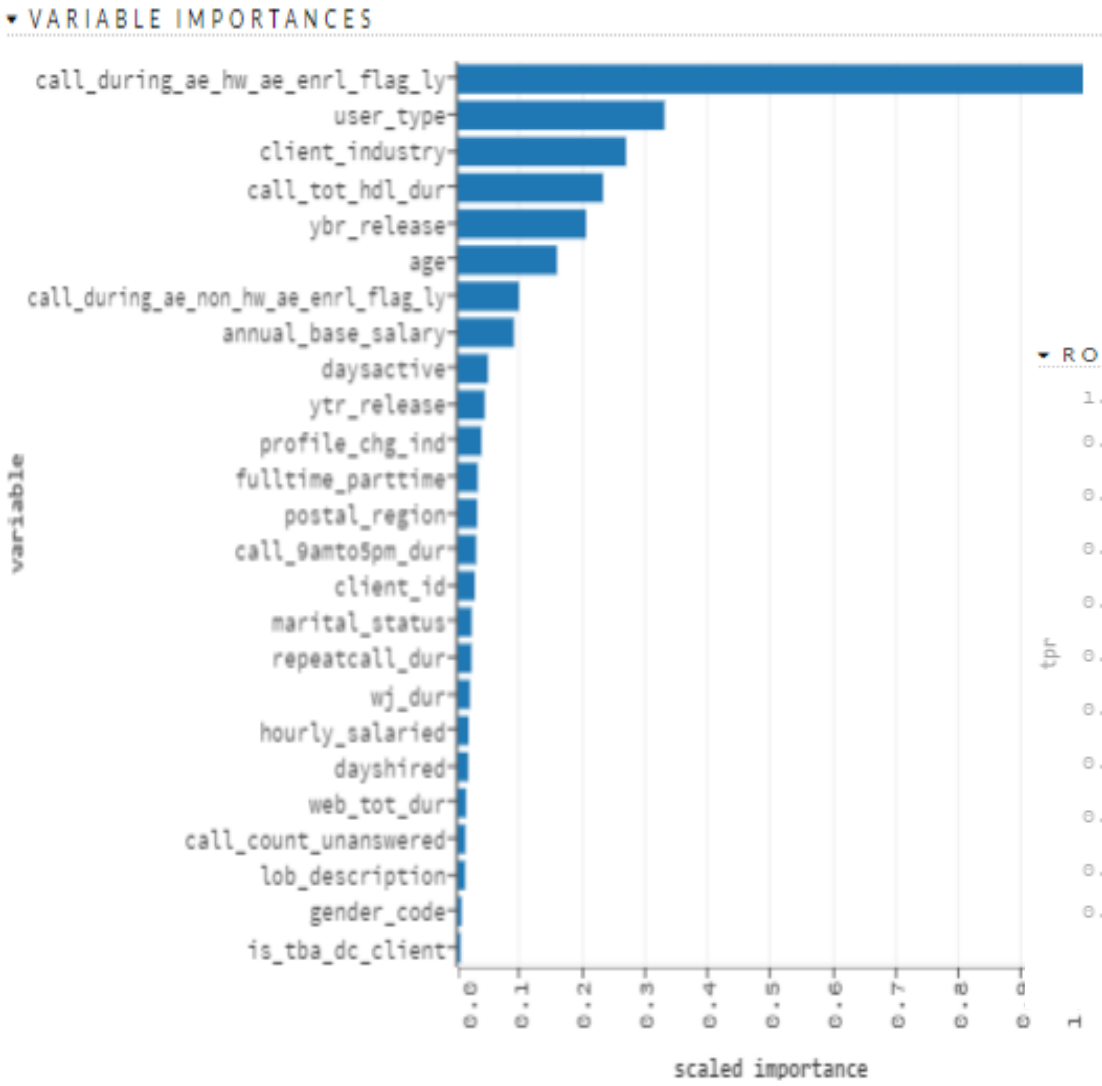
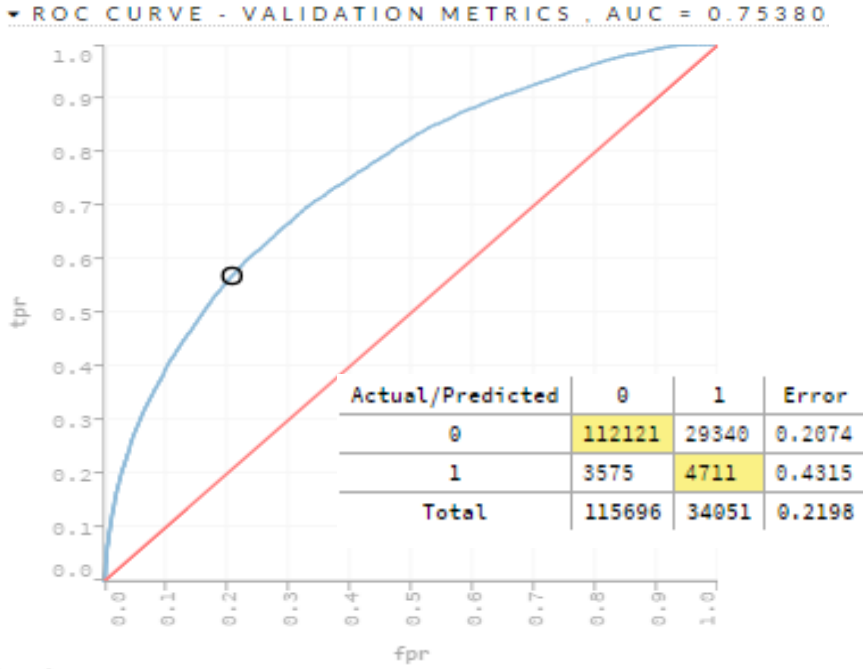



Figure: AdaBoost. Source: Figure 1.2 of [Schapire and Freund, 2012]

# Call Prediction




.90-1 = excellent (A)
.80-.90 = good (B)
**.70-.80 = fair (C)**
.60-.70 = poor (D)
.50-.60 = fail (F)
Source:
http://gim.unmc.edu/dxtests/roc3.htm




| Actual/Predicted | 0 | 1 | Error |
|---|---|---|---|
| 0 | 112121 | 29340 | 0.2074 |
| 1 | 3575 | 4711 | 0.4315 |
| Total | 115696 | 34051 | 0.2198 |



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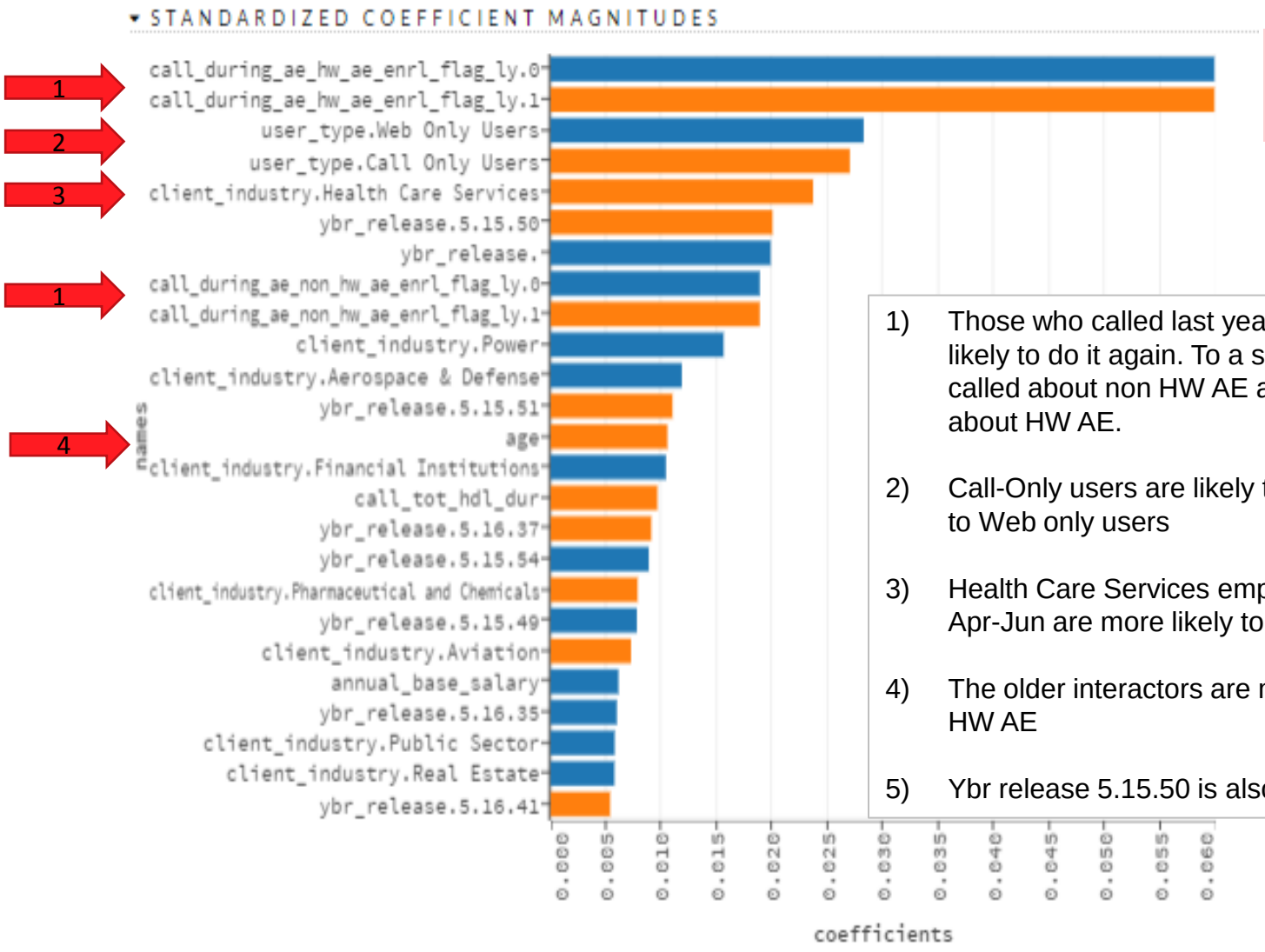
# Call Prediction




1
2
3
1
4

Blue: Negative with Conversion
Orange: Positive with Conversion

1) Those who called last year during AE about HW AE are likely to do it again. To a smaller degree, those who called about non HW AE are also likely to call this year about HW AE.

2) Call-Only users are likely to call during AE as opposed to Web only users

3) Health Care Services employees who interacted during Apr-Jun are more likely to call during AE about HW AE

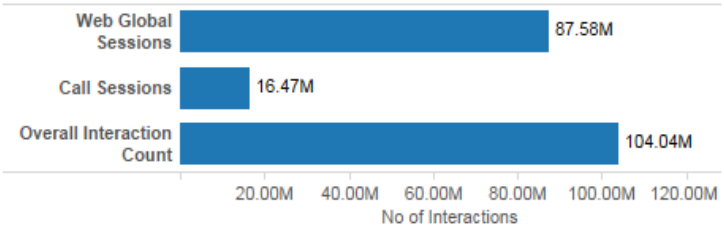
4) The older interactors are more likely to call back about HW AE

5) Ybr release 5.15.50 is also one driver of the conversion

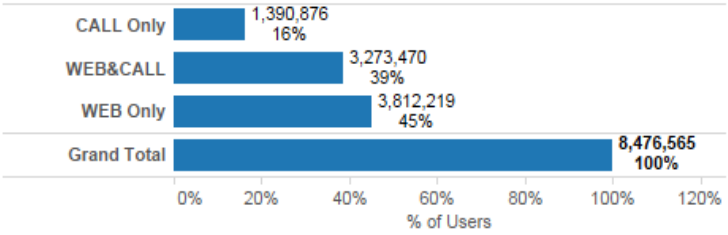
# Interaction Analytics – Web Jumpers

## Web Jumpers Analysis - Interactions Overview

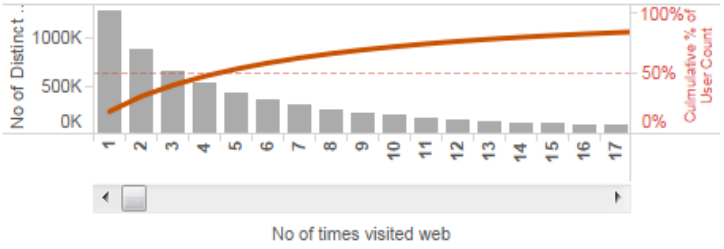
### Overall Interaction Counts




### Overall User Channel Usage

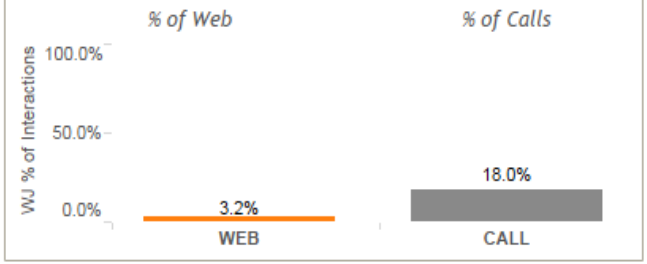



### Overall Web Visit Frequency

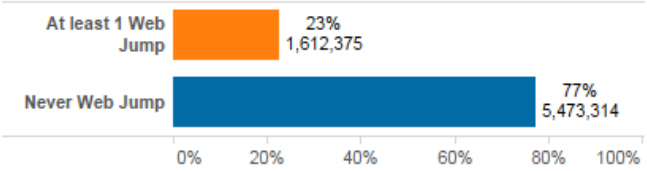



### Total No. of Web Jump Global Web Sessions

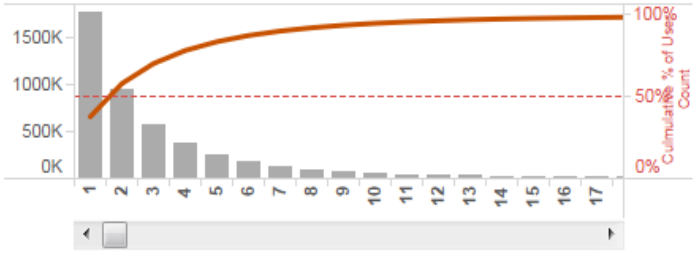
**2,821,303**




### Out of Web Users, how many of them web jump?




### Overall Call Frequency




Client Id

(All)

Month, Year of Interaction Beg..

(All)

AEPeriodInd

(All)

**What is a web jump (WJ)?**

A web jump is defined as a web session leading to a call session within 24 hours from the time of the web visit.

A global session is considered a web jump if any of its web session is a web jump.

* indicates the overall WJ % of total web and call interactions



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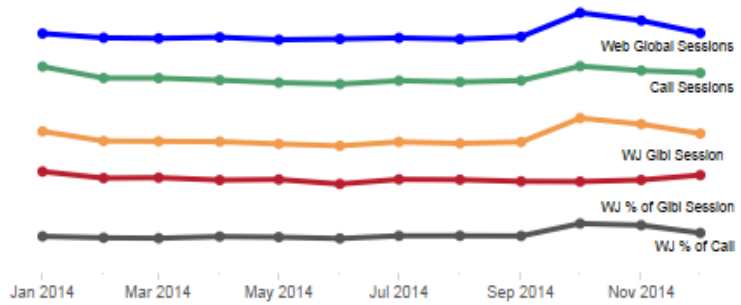
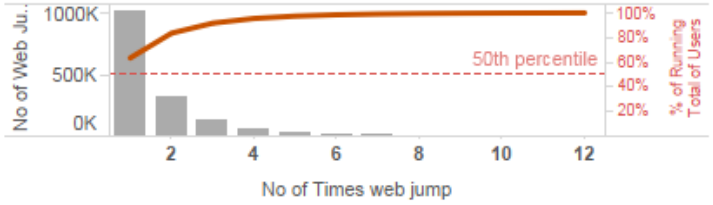
# Interaction Analytics – Web Jumpers

## Web Jumpers Analysis - Web Jumps Overview

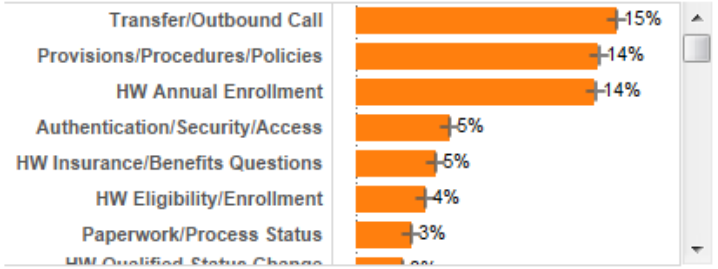
### Trend of Key Metrics




### Web Jump Frequency



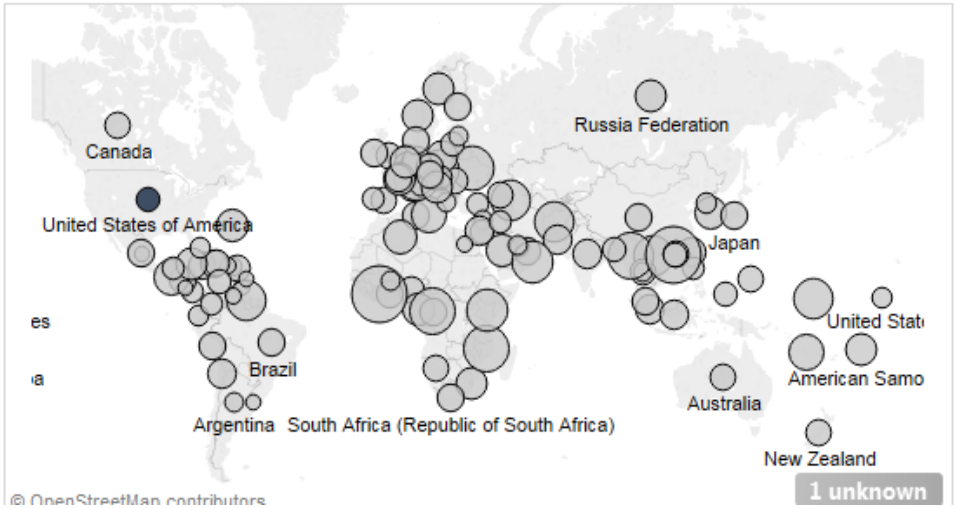

### Call Themes of Web Jumps (Frequent Web Jumpers if selected above)




### Top 10 Users by No of Web Jumps

| IdentifierUser | Client Id | No of WJ | Call S essio.. | WJ % of Cal.. | Web G lobal.. | WJ % of W.. | Overal l Inte.. |
|---|---|---|---|---|---|---|---|
| 120000048/1645 | 1645 | 234 | 636 | 37% | 478 | 49% | 1,114 |
| 232900034/10162 | 10162 | 139 | 197 | 71% | 956 | 14% | 1,153 |
| 233100010/10162 | 10162 | 128 | 175 | 73% | 1,100 | 11% | 1,275 |
| 251000059/1645 | 1645 | 114 | 539 | 21% | 179 | 61% | 718 |
| 318000090/285 | 285 | 109 | 204 | 53% | 304 | 35% | 508 |
| 438900035/10162 | 10162 | 150 | 214 | 70% | 796 | 15% | 1,010 |
| 454010009/10162 | 10162 | 121 | 174 | 70% | 816 | 13% | 990 |
| 460010063/10162 | 10162 | 141 | 179 | 79% | 1,070 | 13% | 1,249 |
| 485000094/1725 | 1725 | 136 | 251 | 54% | 294 | 47% | 545 |
| 498900069/10162 | 10162 | 184 | 270 | 68% | 951 | 17% | 1,221 |

### Where are the Web Jump calls from?




Client Id
(All)

Month, Year of Interacti..
(All)

AEPeriodInd
(All)



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# Thank You!

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