Swiss Re

The Rise of Artificial Intelligence in Insurance – Applications

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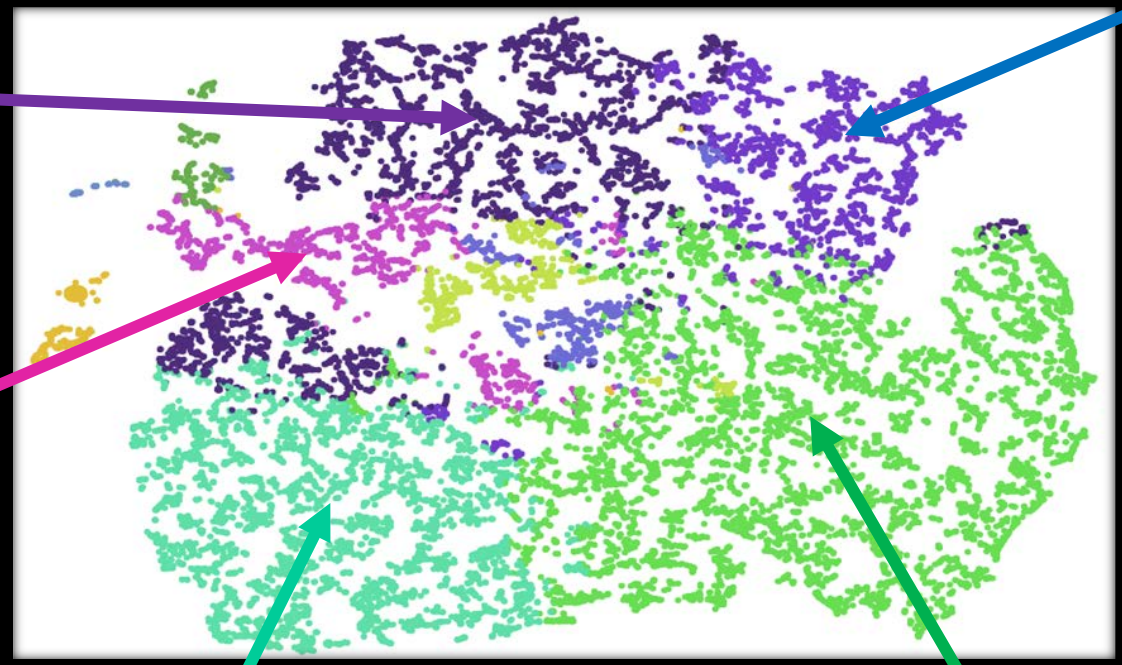
Overview

- The rise of Artificial Intelligence has brought in technology transformation in many industries
- This presentation will show use cases in insurance that leverage the recent developments of AI
- These use cases are being used across the entire insurance value chain
- Artificial Intelligence is used here as a broad terminology that refers to the modeling methods, tools and platforms, applications, big data utilization, and the thought process for problem solving in the field of Artificial Intelligence

Prospecting Clients – Filling the Protection Gap

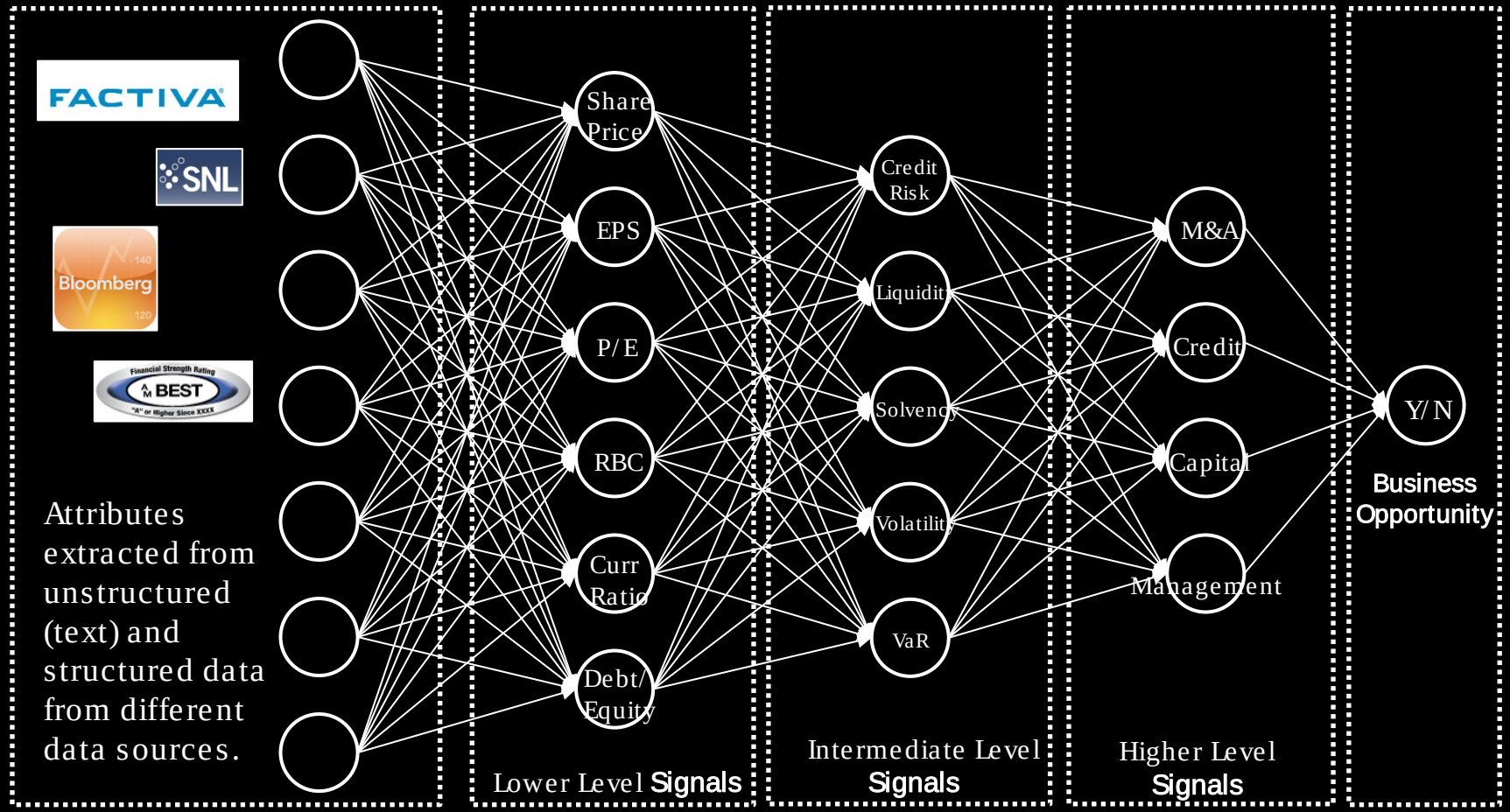
- Use big data and machine learning to better identify and analyze client needs
- Cluster clients based on the need of insurance coverage



An analogy to product recommendation or movie recommendation.

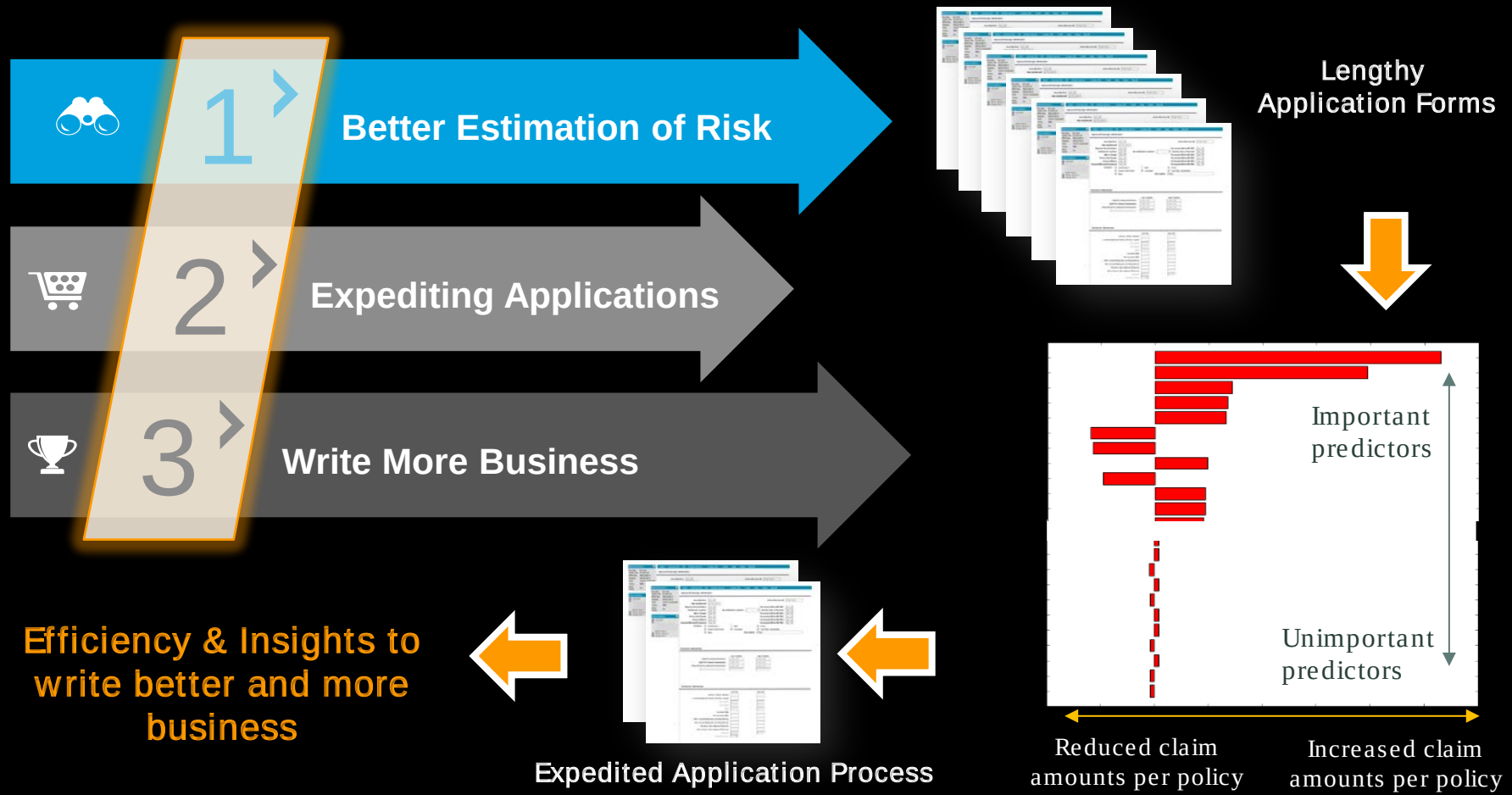
Originating New Business – Market Intelligence

- Monitor market movements to identify business opportunities and mitigate risks



Expediting Application Process

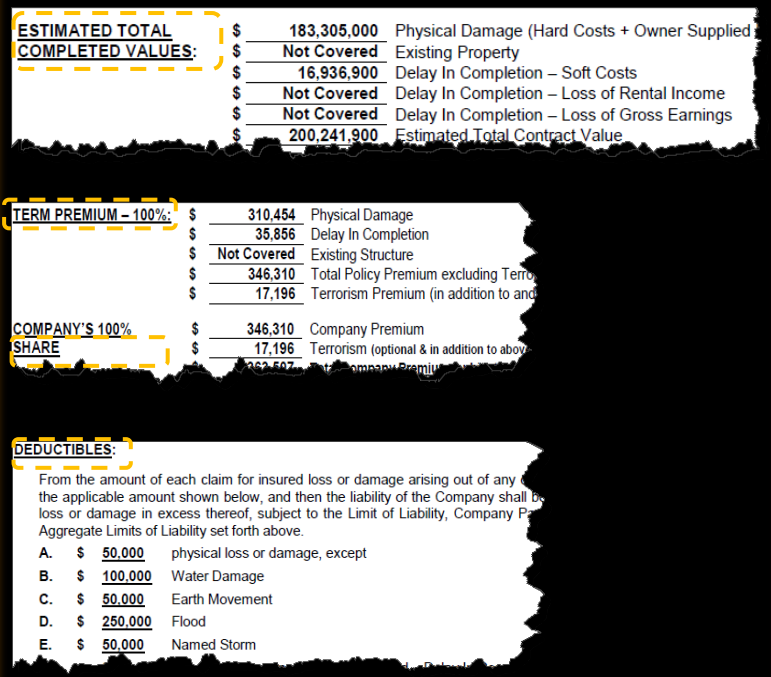
- Expedite the application process while maintaining an accurate quantification of risk



Streamlining Submission Handling

- Automate the information extraction from submission documents to improve efficiency

Machine Reading on Submission Documents



ESTIMATED TOTAL COMPLETED VALUES:	$	183,305,000	Physical Damage (Hard Costs + Owner Supplied
	$	Not Covered	Existing Property
	$	16,936,900	Delay In Completion – Soft Costs
	$	Not Covered	Delay In Completion – Loss of Rental Income
	$	Not Covered	Delay In Completion – Loss of Gross Earnings
	$	200,241,900	Estimated Total Contract Value

TERM PREMIUM – 100%:	$	310,454	Physical Damage
	$	35,856	Delay In Completion
	$	Not Covered	Existing Structure
	$	346,310	Total Policy Premium excluding Terro
	$	17,196	Terrorism Premium (in addition to and
COMPANY'S 100% SHARE	$	346,310	Company Premium
	$	17,196	Terrorism (optional & in addition to abov

DEDUCTIBLES:

From the amount of each claim for insured loss or damage arising out of any
the applicable amount shown below, and then the liability of the Company shall
loss or damage in excess thereof, subject to the Limit of Liability, Company P
Aggregate Limits of Liability set forth above.

A.	$	50,000	physical loss or damage, except
B.	$	100,000	Water Damage
C.	$	50,000	Earth Movement
D.	$	250,000	Flood
E.	$	50,000	Named Storm

Automated Information Extraction

```
def get_total_insured_value(text):
    re2 = "[\w\*\s]*((\$|USD)\s*([\d\., ]+|Not? Covere?d?))\s+([&\w\t\ \*
    re1 = "[\w\*\s]*\n\s*([\w\t\ \*\+\%,\-\(\)\/:&]+)\s+((\$|USD)\s*([\d\

    if re.match(re1, text):
        return [ { "amount": re.sub("\s+"," ",x), "reason": re.sub("\s+",

    elif re.match(re2, text):
        return [ { "amount": re.sub("\s+"," ",x), "reason": re.sub("\s+",

    else:
        return None

def get_premium(text):
    premium = None
    prem_regex = '((\$|USD)\s*[0-9,]+|Not? Covere?d?)\s+([\w\t\ \*\d\%,
    prem = re.findall(prem_regex, text)
    if prem:
        premium = [{'amount':re.sub("\s+"," ",x), 'reason':re.sub("\s+
    return premium
```

```
def get_deductibles(text):
    text = text + "\n"
    regex_ded = r'([A-Z0-9]\.)?\s*((\$|USD)?\s*\d+(,\d+)*(\.\d+)?
    ded_amounts = None
    #for regex in regex_ded:
    deds = re.findall(regex_ded, text)
    ded_amounts = [{'amount': x, 'reason': y} for _,x,_,_,_,y in
    ded_amounts = line_scan(text, ded_amounts)
    return [{'amount': x['amount'] if '%' not in x['amount'] els
  'percentage': x['amount'] if '%' in x['amount'] else re.match(
        if re.match('or \d+\%', x['reason'], re.I) else '',
  'reason': x['reason'] if not re.match('or \d+\%', x['reason']
```

Structured Data Extracted for Efficient Processing

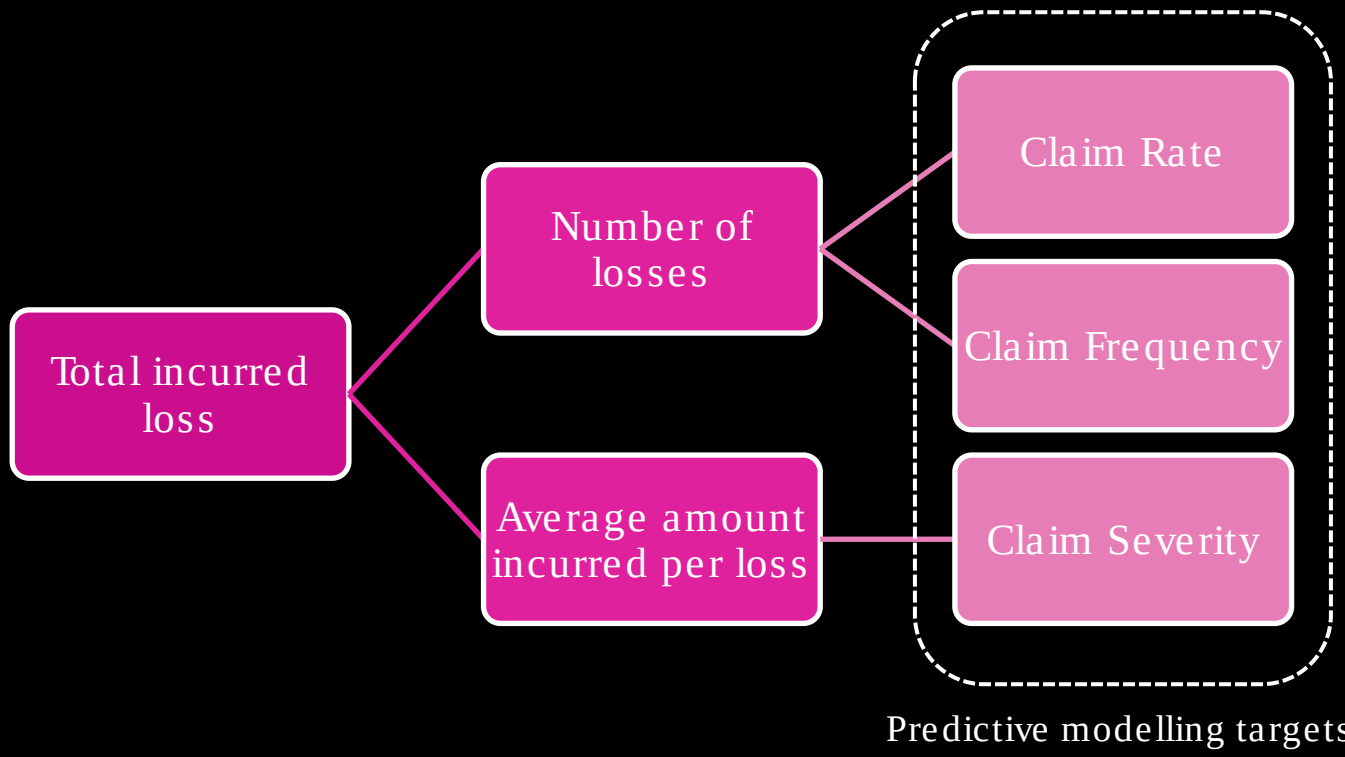
amount	reason	tags
$ 183,305,000	Physical Damage (Hard Costs +	['Physical Damage']
$ Not Covered	Existing Property	['Existing Property']
$ 16,936,900	Delay In Completion Soft Costs	['Delay in Completion', 'Soft Costs']
$ Not Covered	Delay In Completion Loss of Re	['Delay in Completion']
$ Not Covered	Delay In Completion Loss of Gr	['Delay in Completion']
$ 200,241,900	Estimated Total Contract Value	['Total Insured Value']

amount	reason	tags
$ 310,454	Physical Damage	['Physical Damage']
$ 35,856	Delay In Completion	['Delay in Completion']
Not Covered	Existing Structure	[]
$ 346,310	Total Policy Premium excluding Terrorism	['Terrorism']
$ 17,196	Terrorism Premium (in addition to and not i	['Terrorism']
$ 346,310	Company Premium	[]
$ 17,196	Terrorism (optional	['Terrorism']
$ 363,507	Total Company Premium (subject to 25% Mi	[]

amount	reason	tags
$ 50,000	physical loss or damage, except	['Physical Damage']
$ 100,000	Water Damage	['Water Damage']
$ 50,000	Earth Movement	['Earth Movement']
$ 250,000	Flood	['Flood']
$ 50,000	Named Storm	['Named Wind Storm']
21	days Per Occurrence deductible period Delay In (	['Delay in Completion']

Improving Loss Estimate

- Algorithms developed in AI enrich the availability of statistical models for loss estimation
- These models can bring in more accurate loss prediction



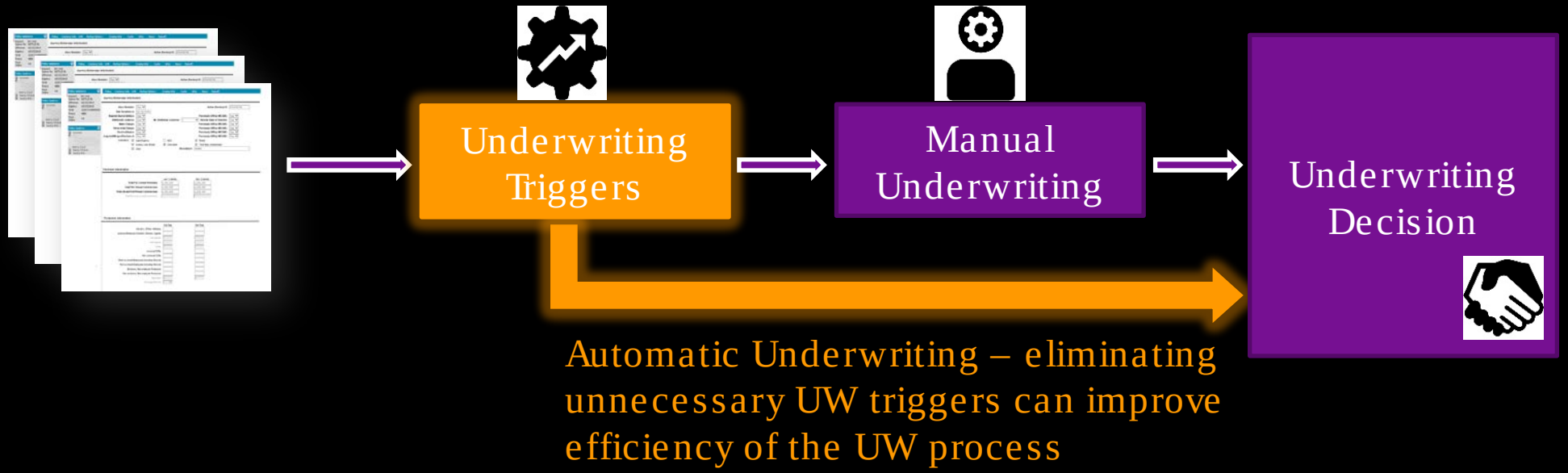
Rich availability of statistical models

- Linear Regression
- Logistic Regression
- Generalized Linear Models
- Decision Tree
- Random Forest
- Gradient Boosting Machine
- Support Vector Machine
- Bayesian Models
- Deep Learning

$$R_{regularized}(\theta) = R_{empirical}(\theta) + Penalty(\theta)$$
$$= \frac{1}{N}\sum_{i=1}^{N} L(y_i, f(x_i;\theta)) + \frac{\lambda}{2N}||\theta||^2$$

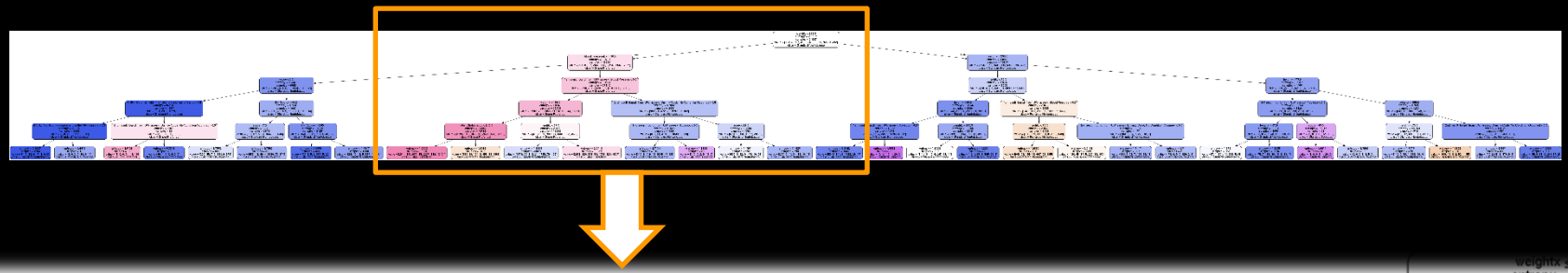
Accelerating Underwriting

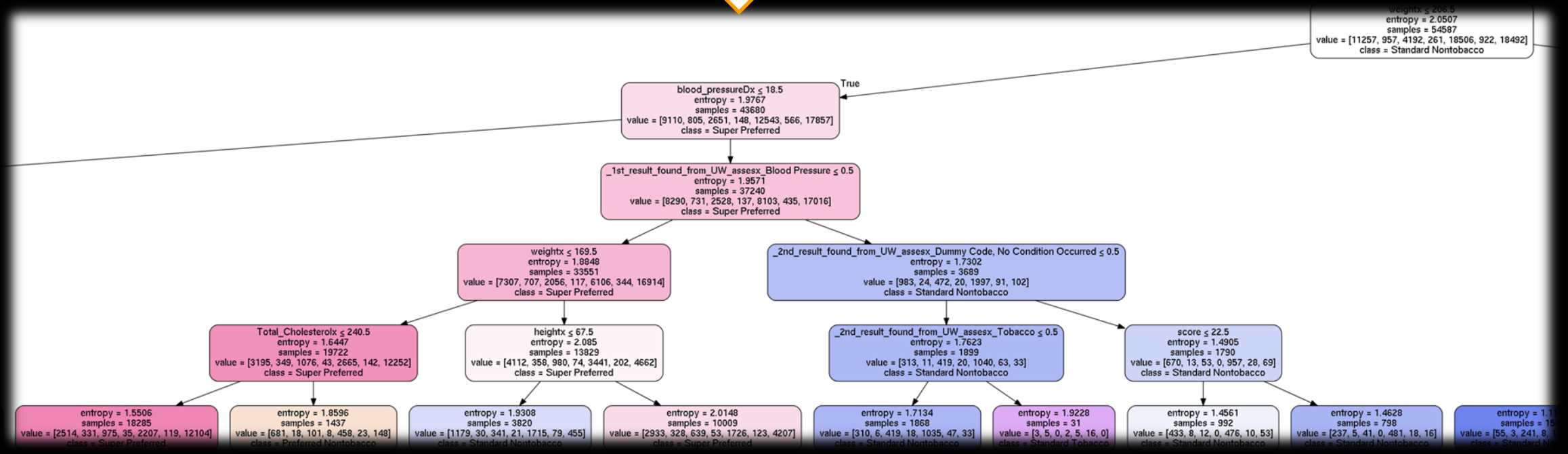
- The effectiveness of the underwriting rules/triggers for loss estimate can be evaluated
- A better underwriting ecosystem can be built to improve the accuracy and efficiency of underwriting



Classifying the Risk Class

- Machine learning models can help better evaluate the risk level during underwriting





Predicting Lapse

- Use inforce data to estimate the likelihood of a policy lapse, which helps proactive customer engagement

Insurance Product

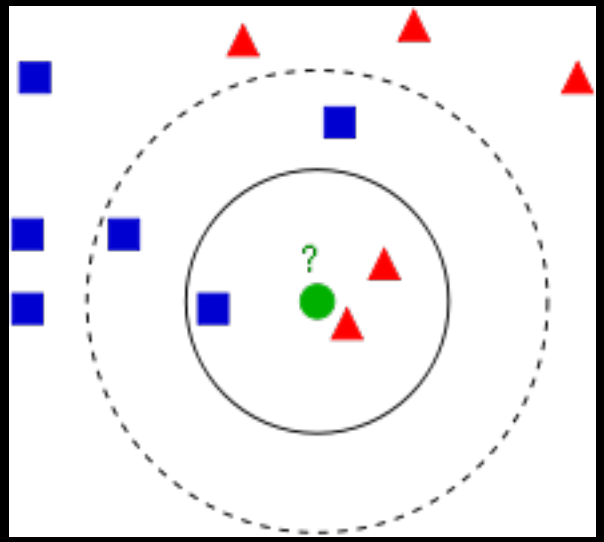
Policy Terms

Age

Premium Payment History

Health Status

Life Changing Events

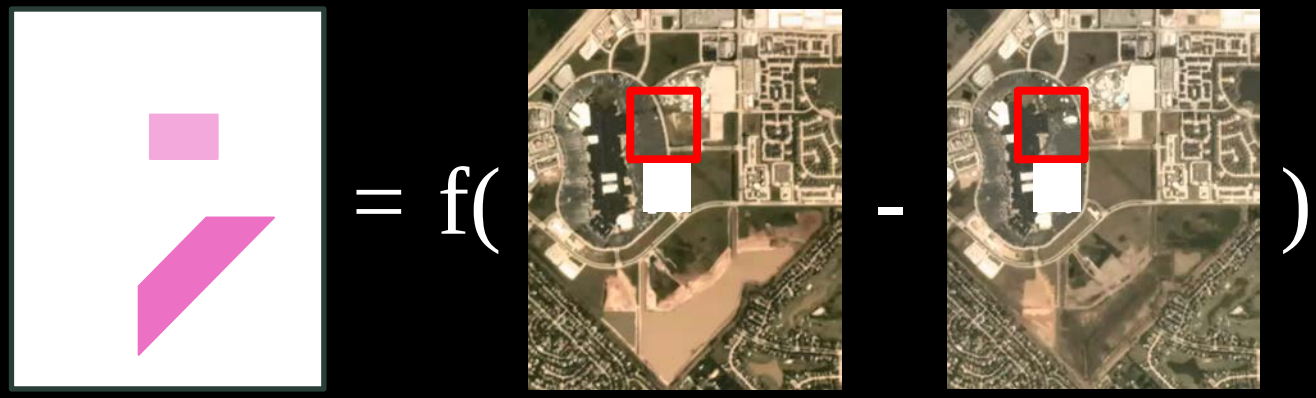


Use algorithms to understand the behavior of policyholders

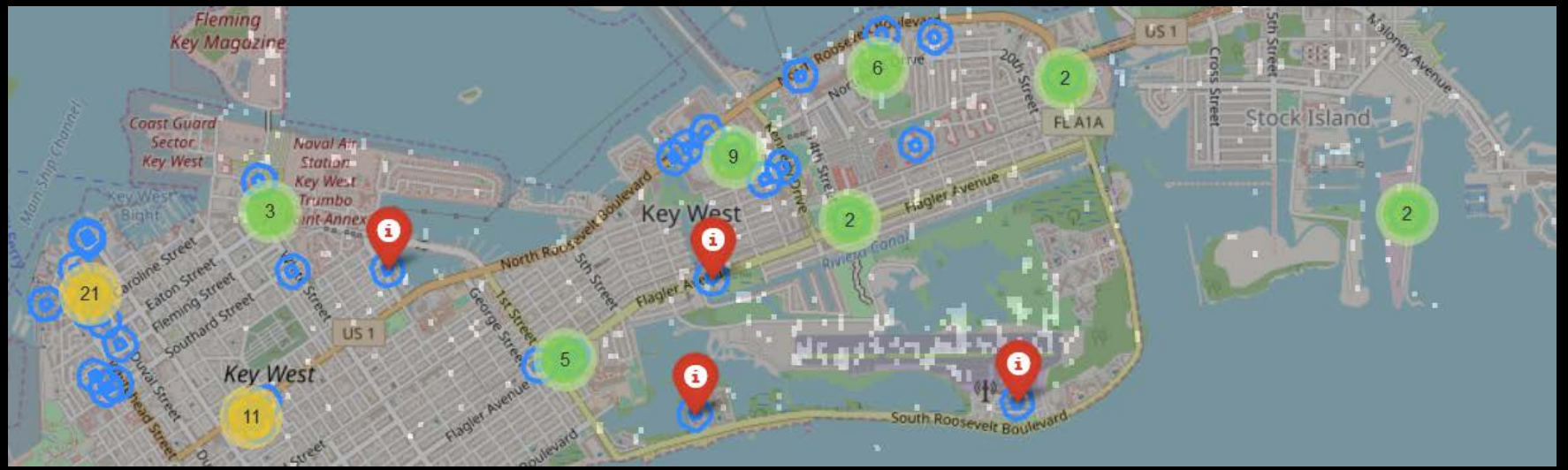
Lapse?
Y/N
or
P(Lapse)

Estimating Claims

- Use of satellite images to expedite damage estimation
- Improved claim estimation
- Reserving/capital preparation
- Proactive customer care

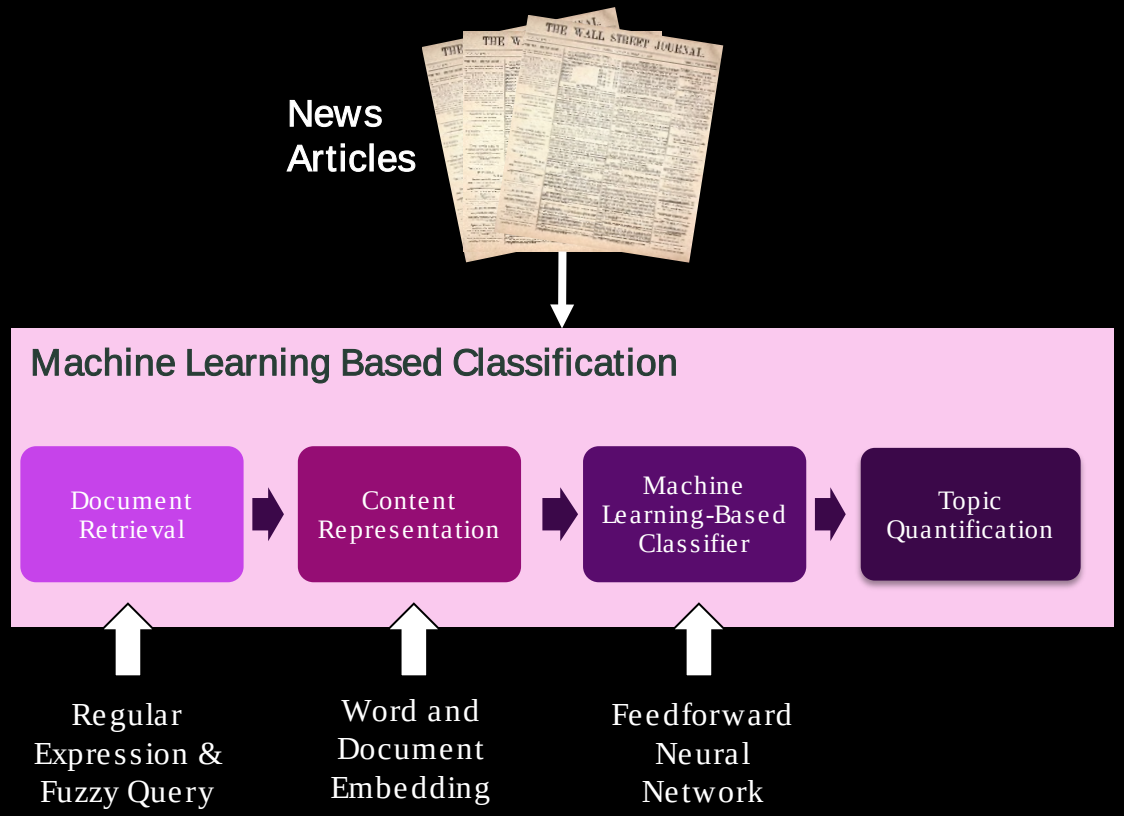


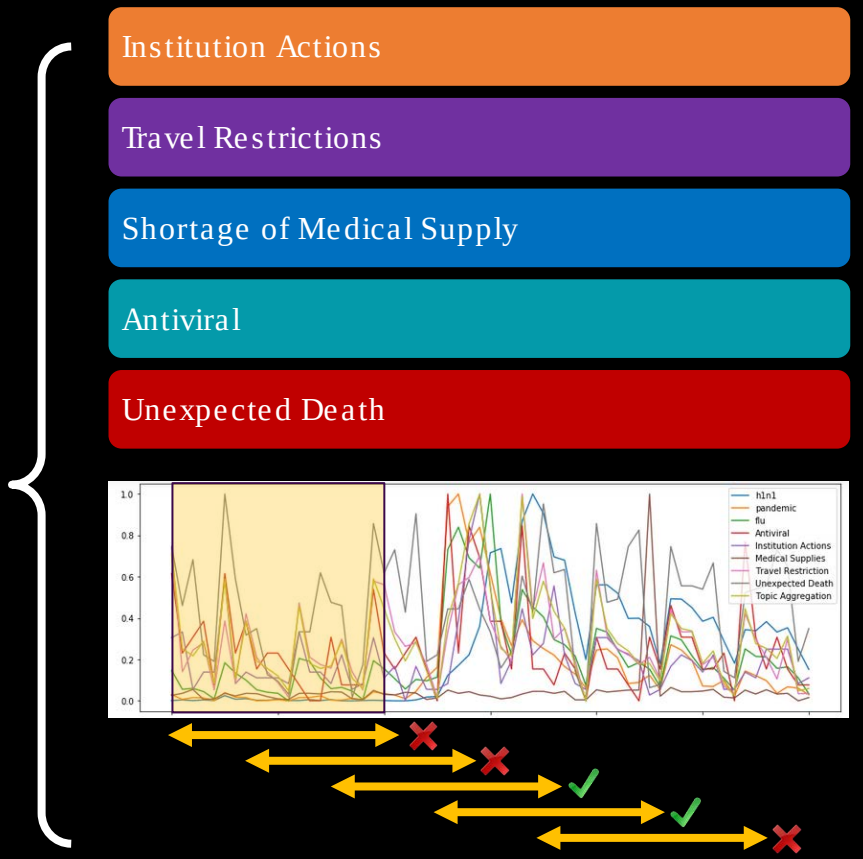
Damagibility D Satellite S_{after} Satellite S_{before}



Identifying Potential Risks

- Mining large scale of data to screen risks, and identify trends of risk development





Summary

- The rise of Artificial Intelligence has brought in technology transformation in many industries
- This presentation discussed use cases in insurance that leverage the recent developments of AI
- Insurance is a highly specialized industry and would need technology customization
- It is still an early stage of the application of AI in insurance but we have already seen many opportunities
- While there are a lot of excitement, we would still need to proceed with cautious in the AI adoption

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