

Harnessing emerging data technologies to move from reaction to prevention





Agroknow



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Standards, Systems, Certifications, Audits, Risk Assessment

The Recals Challenge





Critical Questions:



Which ingredients will be affected by hazards?



What type of emerging issues should I prepare for?





Data in the Food Supply Chain



Scattered, Heterogenous, Multilingual & **Disconnected Data**





MY INGREDIENTS

MY SUPPLIERS





Our vision

"In 10 years I would really like to see all food and agriculture data to be interconnected." Nikos Manouselis, CEO, Agroknow



Putting Tech to Work



BIG DATA PROCESSING

ARTIFICIAL INTELLIGENCE

AUTOMATIC LANGUAGE TRANSLATION

SEMANTIC ANNOTATION





AVAILABLE DATA

21.03.19

46.655 **FOOD RECALLS** BORDER REJECTIONS 284.000 101.000.000 LAB TESTING DATA **COUNTRY RISK DATA** 904 216.000 INSPECTIONS **PRICE DATA** 367.000 **462** OUTBREAKS

INTERCONNECT **RECALLS WITH LAB TESTS RESULTS**

> 100 Million data points **35** countries







Move from knowing what happened to predicting risks



Method in this study



CREATE TAILOR-MADE DATASETS FOR **EACH SECTOR**

SELECT THE AI ALGORITHM

Polychronou, I., Katsivelis, P., Papakonstantinou, M., Stoitsis, G., & Manouselis, N. (2020, February). Machine Learning Algorithms for Food Intelligence: Towards a Method for More Accurate Predictions. In International Symposium on Environmental Software Systems (pp. 165-172). Springer, Cham.





Al Algorithms Tested





MACHINE LEARNING



BAYESIAN RIDGE REGRESSION DECISION TREE REGRESSION RANDOM FOREST REGRESSION K-NEAREST NEIGHBORS REGRESSION

LONG SHORT-TERM MEMORY PROPHET





Results

FOR WHICH INGREDIENT CATEGORIES RECALLS AND BORDER **REJECTIONS WILL INCREASE?**

Ingredient category	What happened in 2019	What our best algorithm predicted for 2019	What will happen in 2020	Tren
Nuts and nuts products	706	698 (93% KNN)	722	+2%
Non-alcoholic beverages	184	187 (98% Decision Tree)	188	+2%
Cereals and Bakery products	665	661 (99% LSTM)	760	+14%
Milk and milk products	316	267 (84% LSTM)	307	-3%
Chocolate products	102	91 (89% LSTM)	110	+8%
Fruits and vegetables	1170	1228 (95%)	1198	+2%
Herbs and Spices	587	449 (75% LSTM)	502	-15%
Ice creams	44	65 (54% LSTM)	64	+45%





WHICH CHOCOLATE INGREDIENTS WILL HAVE THE MOST HAZARDS?

Ingredient	What happened in 2019	
Cocoa	22	
Peanuts	117	
Hazelnuts	40	
Almonds	70	
Palm oil	17	



What our best algorithm predicted for 2019	What will happen in 2020	Trend
24 (72% Random forest regression)	25	+14%
122 (95% Random forest regression)	132	+13%
44 (55% Random forest regression)	48	+20%
104 (52% Random forest regression)	104	+48%
12 (68% Random forest regression)	13	-23%



WHICH HAZARDS WILL INCREASE IN PEANUTS?

Hazards	What happened in 2019	What our best algorithm predicted for 2019	What will happen in 2020	Trend
Chemical	101	102 (97% Random forest regression)	102	0%
Mycotoxins	101	124 (77% Random forest regression)	102	0%
Aflatoxin	101	102 (98% Random forest regression)	106	+4%







Predicting recall of a chocolate product

Chocolate bar

INGREDIENTS

MILK CHOCOLATE (SUGAR, COCOA BUTTER, CHOCOLATE, SKIM MILK, LACTOSE, MILKFAT, SOY LECITHIN, ARTIFICIAL FLAVOR)

PEANUTS

CORN SYRUP

SUGAR

PALM OIL

SKIM MILK LACTOSE SALT EGG WHITES ARTIFICIAL FLAVOR



Border rejection

THURSDAY 24 JANUARY 2019

ORIGIN: CHINA

DISTRIBUTION COUNTRIES: JAPAN

AFLATOXIN IN CHOCOLATE BY FROM CHINA

Summary: Aflatoxin (mycotoxin) 24µg/kg (b1:20.7, b2:2.0) detected in chocolate

Hazard: Chemical > mycotoxin > aflatoxin

Product category:

Product category: Chocolate

Supplier:

Cocoa & cocoa preparations, coffee & tea > chocolate & chocolate products > chocolates



PREDICTION OF AFLATOXIN IN PEANUTS

Prediction

Actual value



Move from reaction to prevention

Towards a Live **Predictions Dashboard**

1. Continuously incorporate new data, re-train & re-parameterize model

2. Calculate new predictions

ACTIVATE PREVENTIVE MEASURES

STEP 01 Identify the risky points of your supply chain

Design the most efficient lab analysis plans that will focus on the emerging hazards

STEP 03

STEP 02

Activate early the corrective measures for the risky points of the supply chain

STEP 04

Design the most efficient audits plan

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MEET US AT BOOTH #2

