Innovative uses of web scraped data in the Canadian Clothing and Footwear Consumer Price Index

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Outline

- Background
- Web scraping
- Classification
- Index number formula
- Integration of web scraped data
- Future work

Background

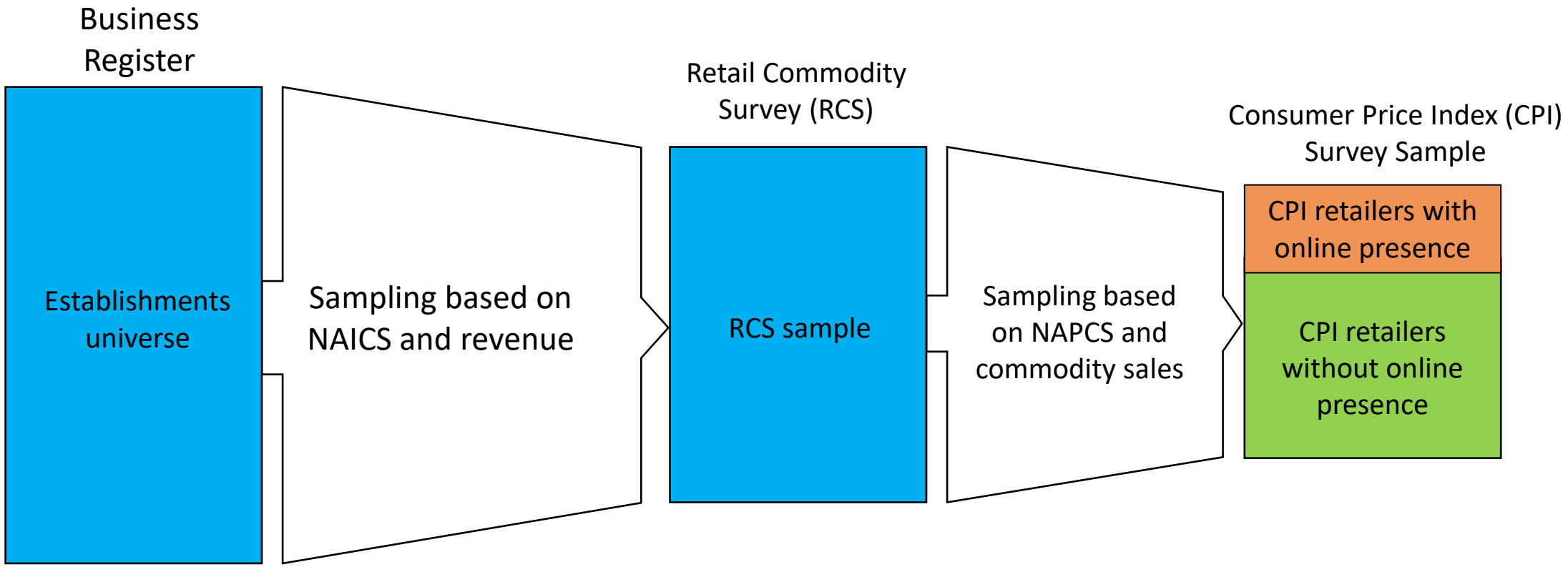
E-commerce expanded

Source: Table 20-10-0072-01 Retail e-commerce sales, unadjusted (x 1,000)

Source: Aston, Vipond, Virgin and Youssouf (2000) - *Statistics Canada* - *Catalogue no. 45280001*

Background

Traditional field collection may not provide sufficient coverage of online products



NAICS: North American Industry Classification System

NAPCS: North American Product Classification System

Background

Implementation strategy

- **Progressively replace field collected data with web scraped data:** For retailers included in the CPI sample having both physical store and online presence.

- **January 2020: First introduction of web scraped data in production**

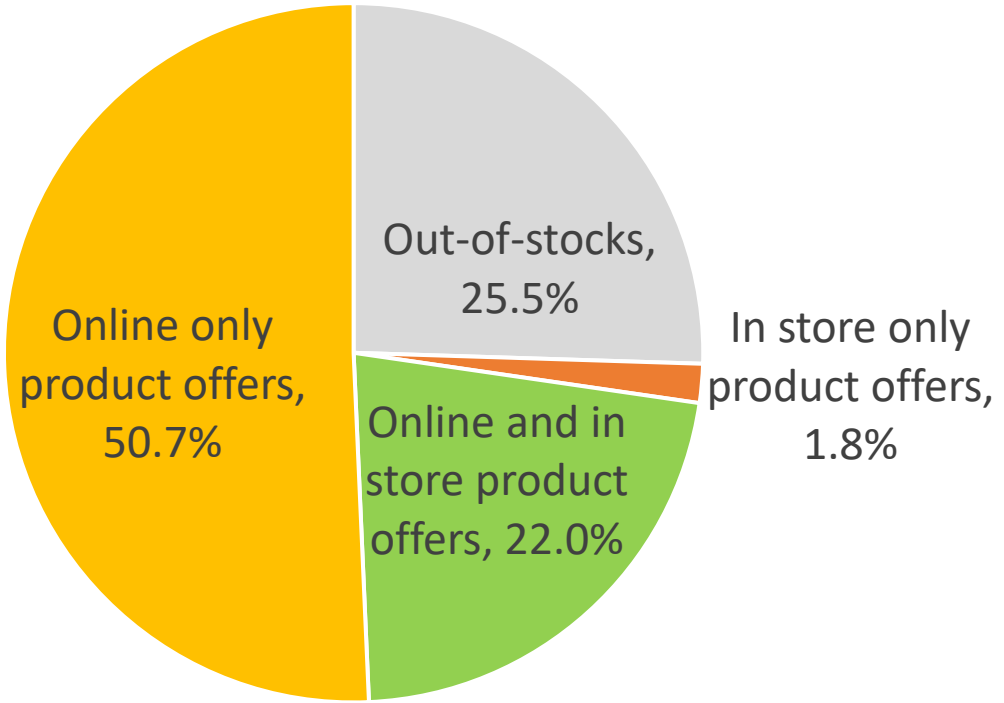
  - Three selected retailers were included in the web scraped collection and processing method.

  - They represented together 8% of the apparel market in 2019.

  - Statistics Canada interviewers are collecting approximately 10% fewer prices in the clothing and footwear retail stores every months.

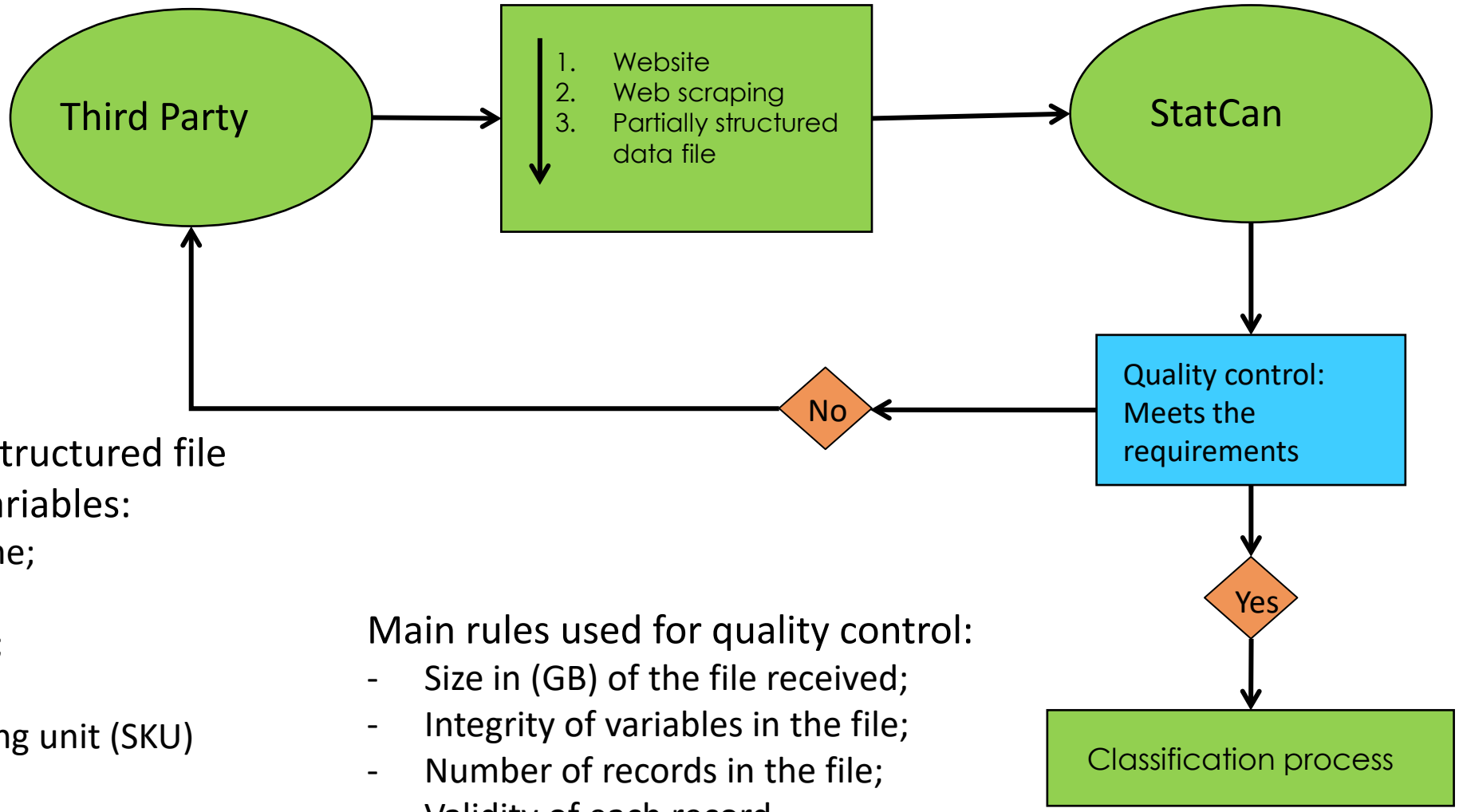
Web scraped data improves coverage

Three web scraped retailers: Distribution of products offered according to their availability in stores or online



Source: January 2020 web scraped data

Web scraping



The partially structured file contains 29 variables:

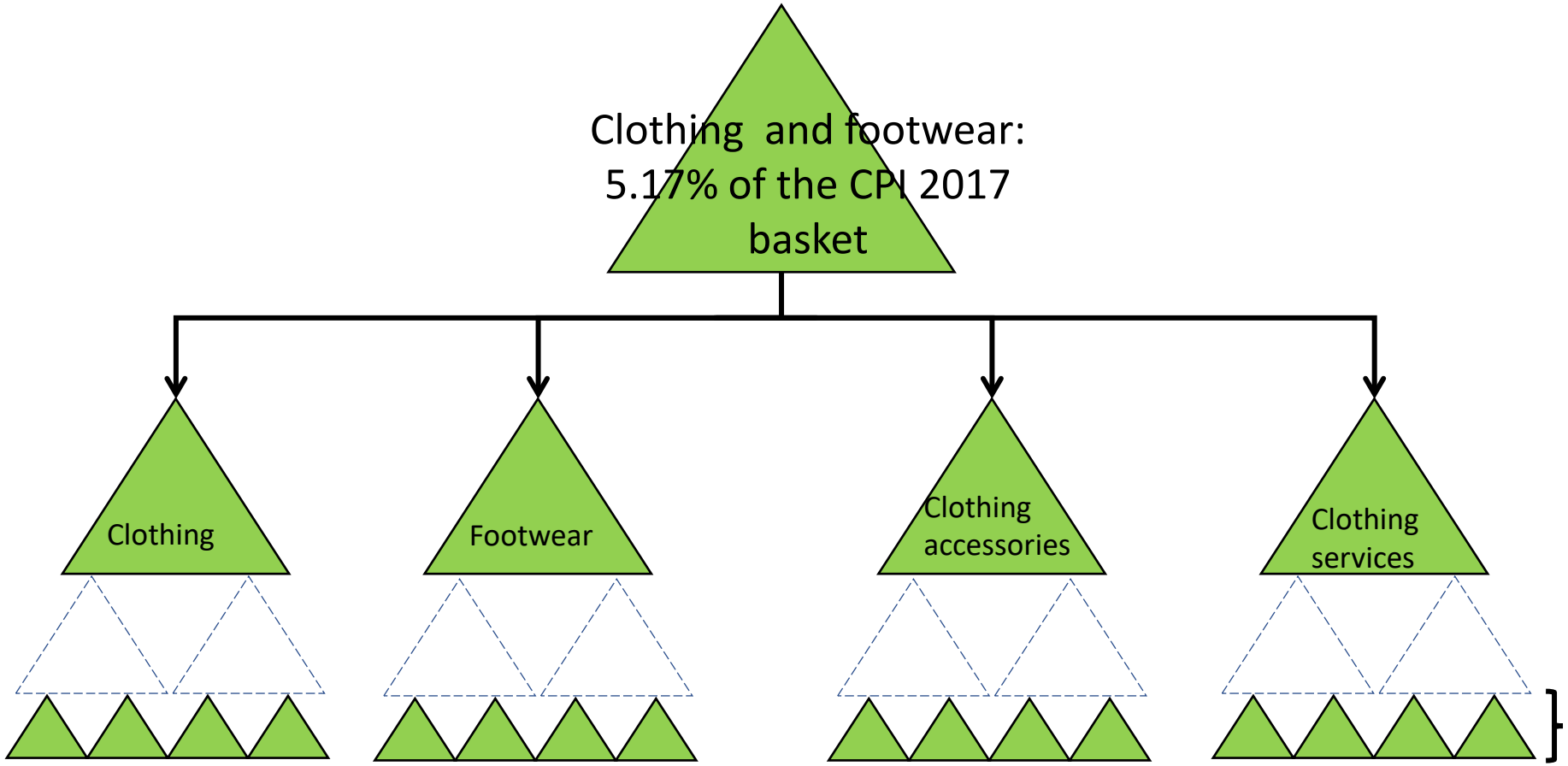
- Product name;
- Category;
- Description;
- Features;
- Stock keeping unit (SKU) identifier;
- Etc.

Main rules used for quality control:

- Size in (GB) of the file received;
- Integrity of variables in the file;
- Number of records in the file;
- Validity of each record.

Classification

Clothing and footwear sub-components



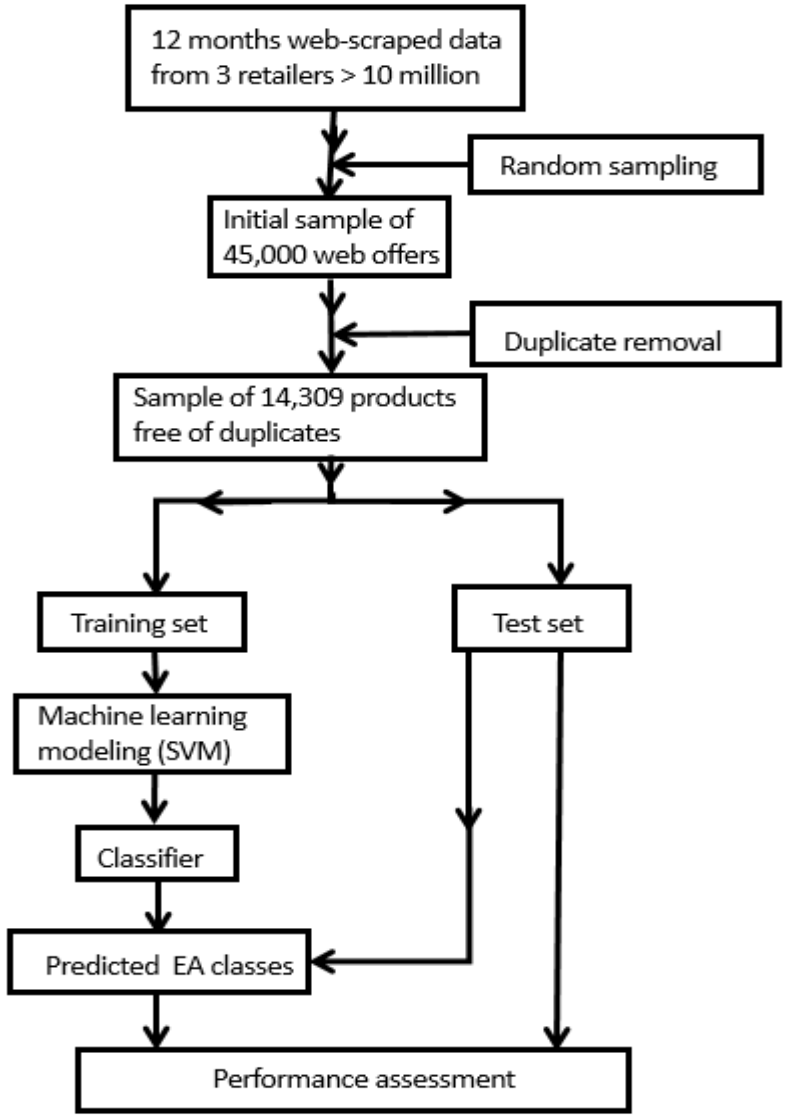
Classification

Development of the Support Vector Machine (SVM) classifier

- **F_1 score** = Average of Precision and Recall.
  - SVM: 92.2%
  - Random Forest: 87.8%

- **Precision** = percentage of relevant classification among the set of products that are assigned to the EA by the classifier

- **Recall** = percentage of relevant classification among the set of products that effectively should belong to the EA



Labelling

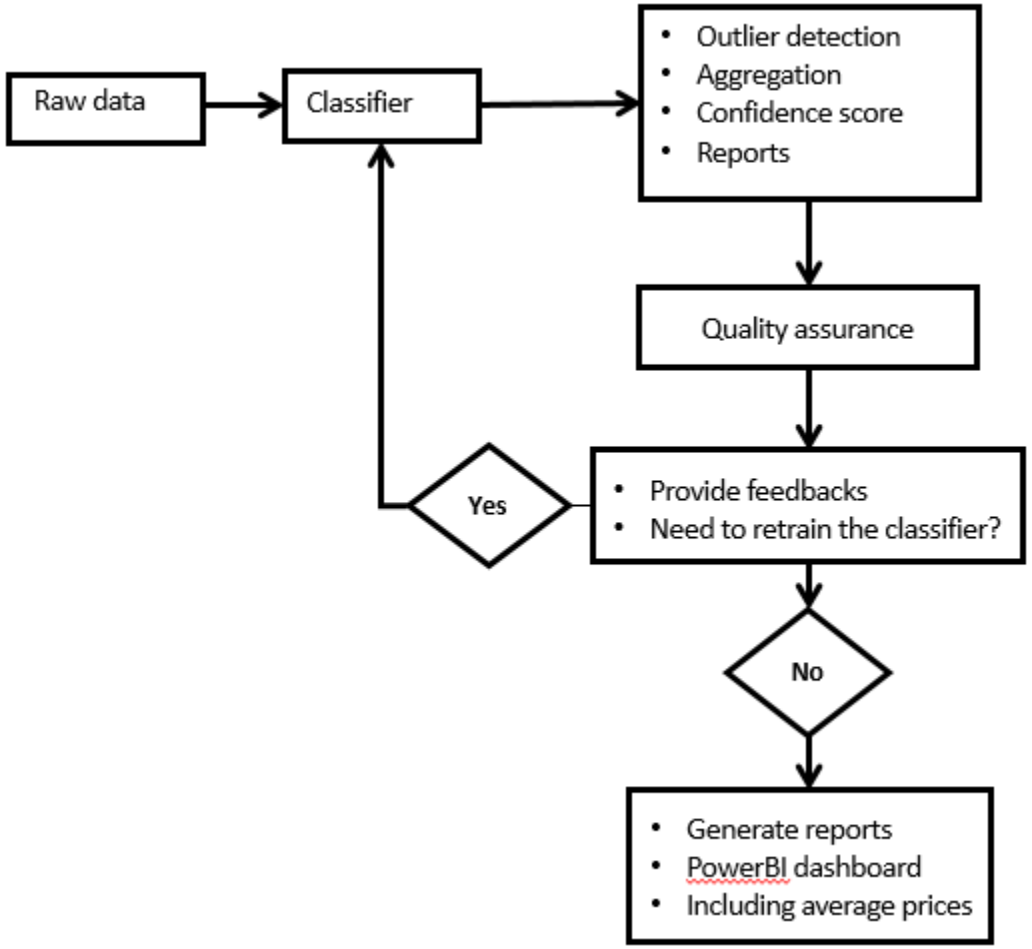
Modelling

Performance assessment using F_1 score

Classification

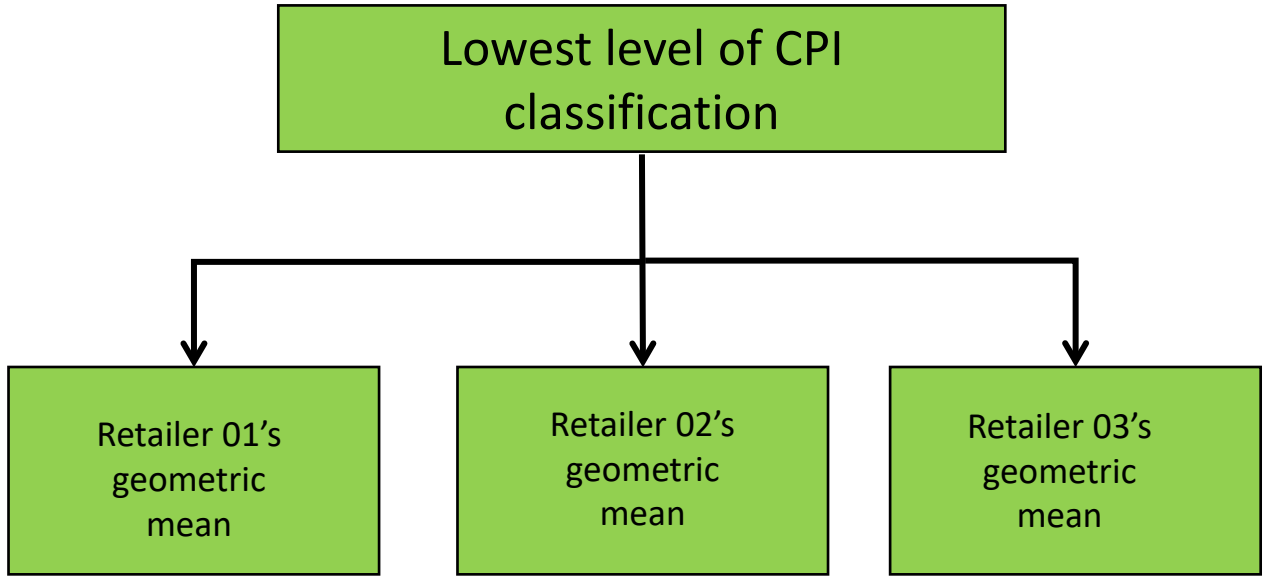
Implementation of the SVM classifier

- **Monthly run of the classifier**



- **Quality assurance (Summary from Jan 2020 to Feb 2021)**
  - Average number of manually verified unique products per month is 3,877;
  - Average precision or average percentage of well-classified products is 95.0%, which is considered a satisfactory performance

Index number formula

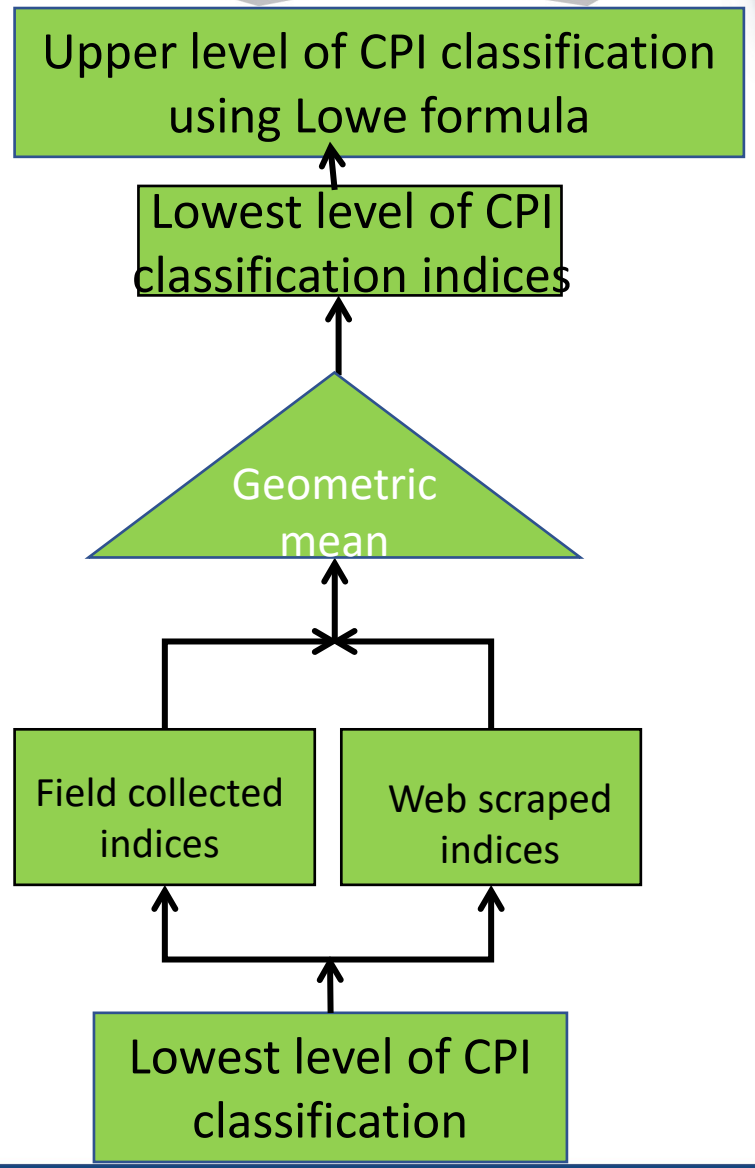


- Use all the product offers

- Consistent with the Jevons formula used to aggregate all field collection price quotes at the lowest level of the CPI classification

Integration of web scraped data

- Assume retailer has a national pricing strategy
- Calculated prices are used in all geographies where the retailer operates through either brick and mortar stores or a warehouse for local product shipping
- Before implementing the web scraping methodology for the three retailers in production, we did parallel runs to assess its effect on the CPI

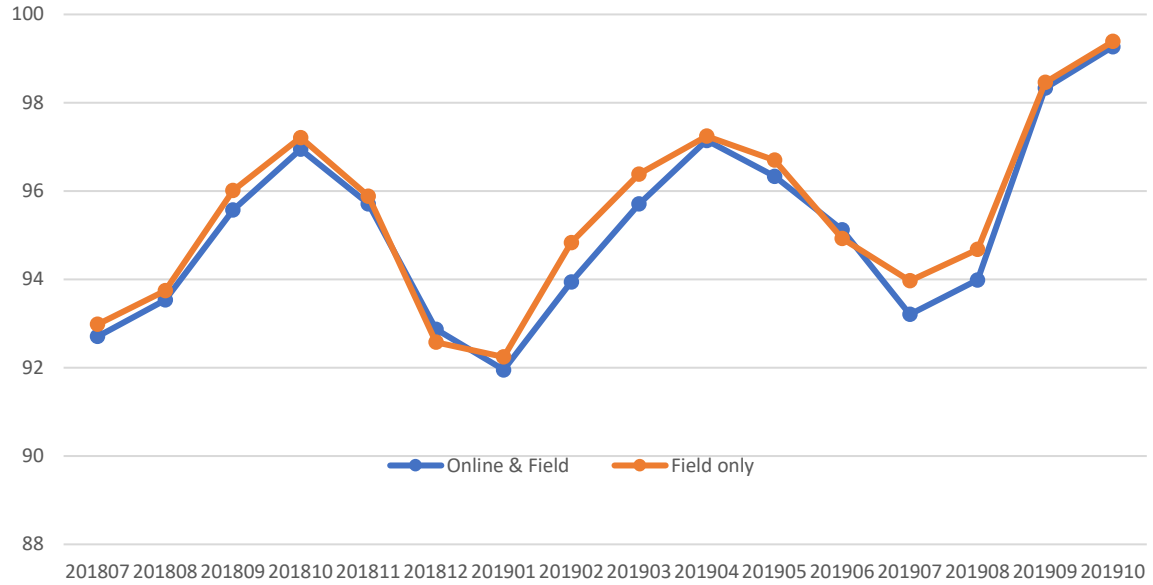


Integration of web-scraped data

Parallel runs

Negligible impact of web-scraped methodology on the all-items CPI

Web-scraped closely tracks the trend in the field collected clothing and footwear CPI



Future work and research development to improve the use of web scraped data in the CPI

- **Development of a user interface application for web scraped data processes**
  - Would efficiently support the web scraped data processes and minimise the risk of errors
- **Active learning**
  - Cost efficient in terms of sample selection for the labelling of future retailers to include in the web scraped methodology;
- **Clustering**
  - Mitigate the impact of product churn;
- **Outlier detection**
  - Efficiently target the candidates for quality assurance (QA)
- **Treatment of outliers**
  - Develop an outlier robust geometric mean M-estimator;

Conclusion

- Statistics Canada is leading the way of unique mode field collected data toward alternative data source to improve the coverage and the quality of the CPI

- Research and development are conducted to smoothly include additional retailers into the web scraped collection and processing method

Thank you!

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