

12<sup>th</sup> IMF Statistical Forum

MEASURING THE IMPLICATIONS OF  
**AI ON THE  
ECONOMY**

NOVEMBER 20-21

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#StatsForum



STATISTICS

# Harnessing AI for Labour Market Statistics

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# Manpower Research and Statistics Department (Singapore)

- The Manpower Research and Statistics Department (MRSD) is Singapore's national labour market statistics agency.
- MRSD manages end-to-end statistical production, including data collection, processing, analysis, report production and dissemination.



# Singapore's Survey landscape

- MRSD conducts around ~40 national research annually, collecting information on...

**4** million  
individuals

**150** thousand  
companies

- The data is translated to data product available on our dissemination portal (StatShare), annually achieving...

**2** million  
page views

**600** thousand  
visitors

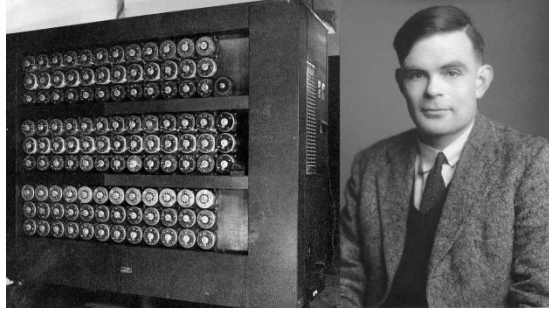
# Current Survey Challenges

- Time-consuming
- Labor-intensive and lack of stability of survey workers
- Constant bombardment by surveys from government and organizations. People often ignore invitations or dropout halfway through, especially if the survey is long and cumbersome.

“How can we leverage on AI and Technology to improve the situation?”



# Evolution of AI



- **1950** Alan Turing – “Computing Machinery and Intelligence”
- 1972 PROLOG programming language
- 1997 IBM’s Deep Blue defeat chess champion
- **2018** Introduction of BERT model  
Introduction of Large Language Model (ChatGPT, Gemini)

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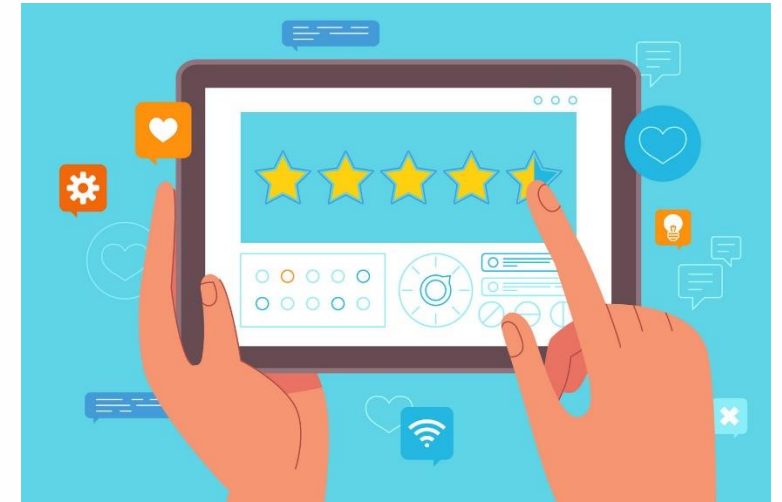
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# Singapore's Survey Struggle

- Manpower Research and Statistics Department conduct **~44 national surveys**
- **Survey coverage:**
  - ▶ Labour Force Survey
  - ▶ Labour Market Survey
  - ▶ Topical survey: wages practices, foreign workers, etc
- **Modality:** Face-to-face interviews, phone calls, online forms, and the dreaded mail questionnaire
- **Challenges:** Time-consuming and labour-intensive

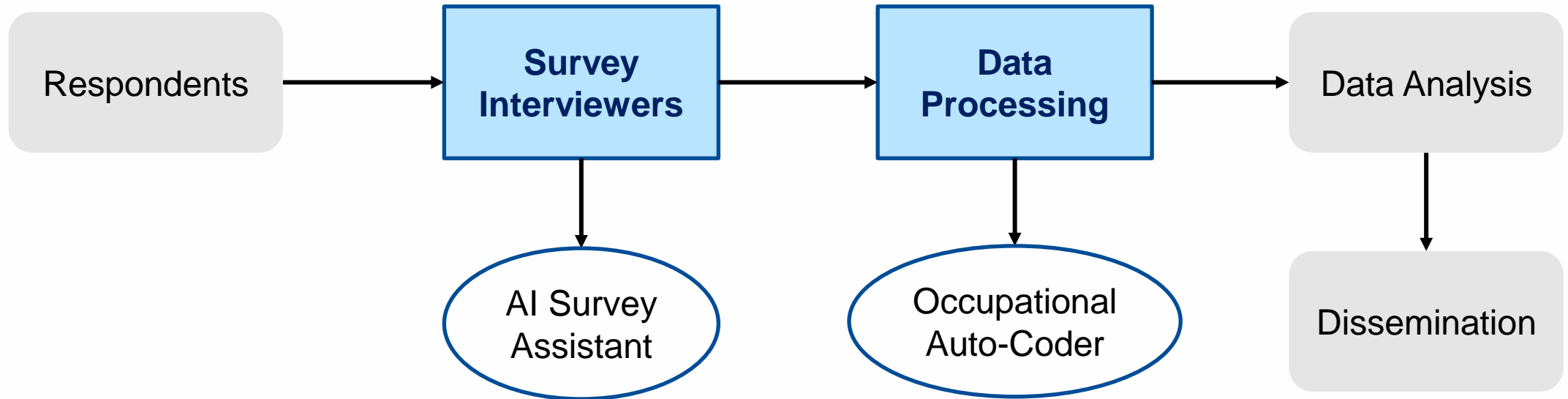


# Change in Respondent's Behaviour

- **Attention spans** shorter than a TikTok video (15 seconds? Too long!)
- **Privacy concerns:** "Is Big Brother watching?"
- **Expectations higher** than Singapore's skyscrapers
- The **"I want it now!"** generation
- **Survey fatigue:** When "Not another one!" becomes common lingo
- **Rise of scam:** Skepticism about data sharing



# Identification of AI Opportunities



# Using Machines To Code Occupations

# Challenges in Occupation Coding

- In the compilation of national statistics, a reference code is assigned to a response for standardization purposes.
- Example

Job Title	Coded Occupation Title
Party Specialist	Exhibition/Conference/Event planner
Dosimetrist	Radiation Therapist
Assembly Operator (Optical)	Precision optics technician

- We use the **Singapore Occupational Classification (SSOC)** for standardization of occupation. This is mirror after International Standard Classification of Occupations (ISCO) developed by the International Labour Organization.

# Manual Coding is Tedious

- Respondents submit their job title and job duties
- The interviewer role is to make sense of the info and go through ~1,000 codes to assign the most appropriate SSOC.

## Example:

**Job title :** Server wizard

**Job duties:** Ensure that the servers are functioning and guard against attack from evil creatures. Maintaining and administering computer networks and related computing environments including systems software, applications software and all configurations



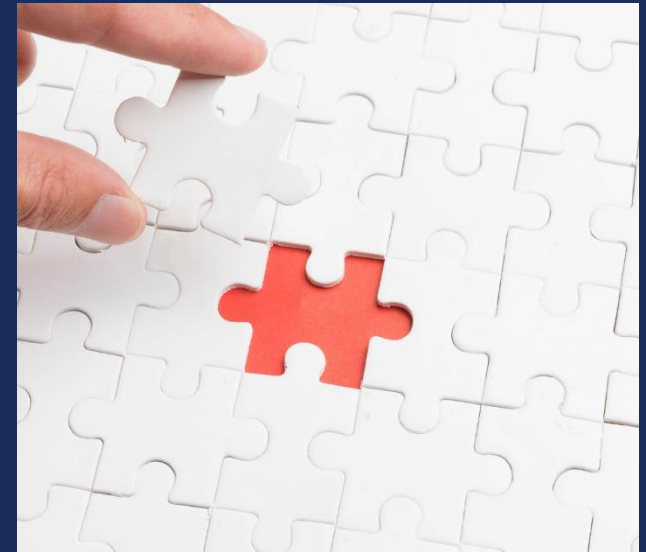
# Manual Coding is Tedious and potentially error prone

- Based on **SSOC**, the occupation code is Network, servers and computer systems administrator (25220).
- Interviewers will need to code approximately 200k records a month which is highly cumbersome and there is ambiguity in understanding and translation.



# PROBLEM STATEMENT

How can we automate the process for the manual assignment of occupation codes with high accuracy?





# Choice of Model: BERT

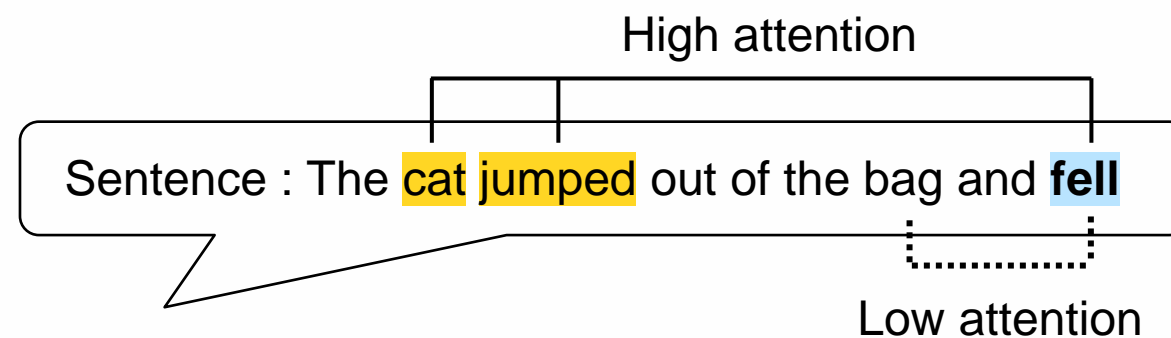


BERT stands for **Bidirectional Encoder Representation of Transformers**, developed by Google in 2018.

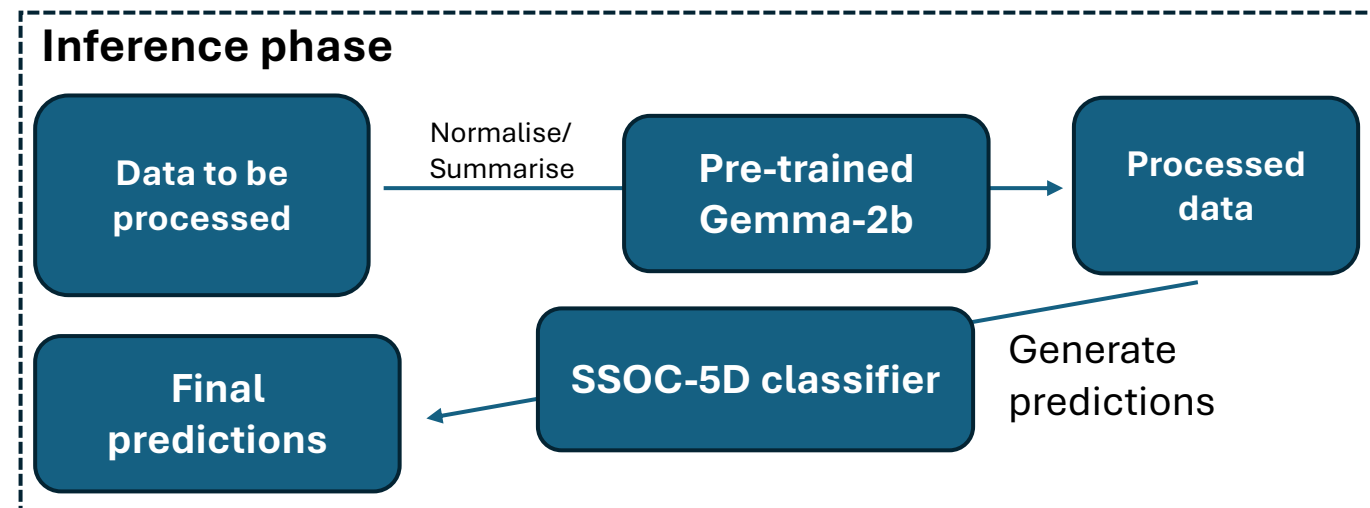
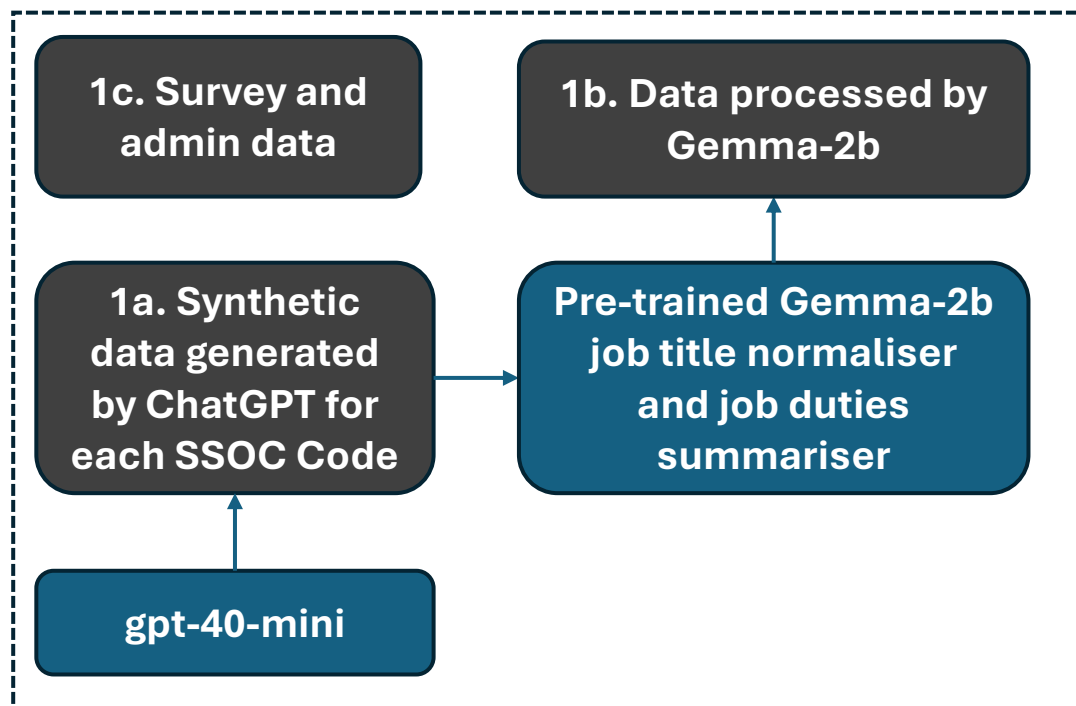
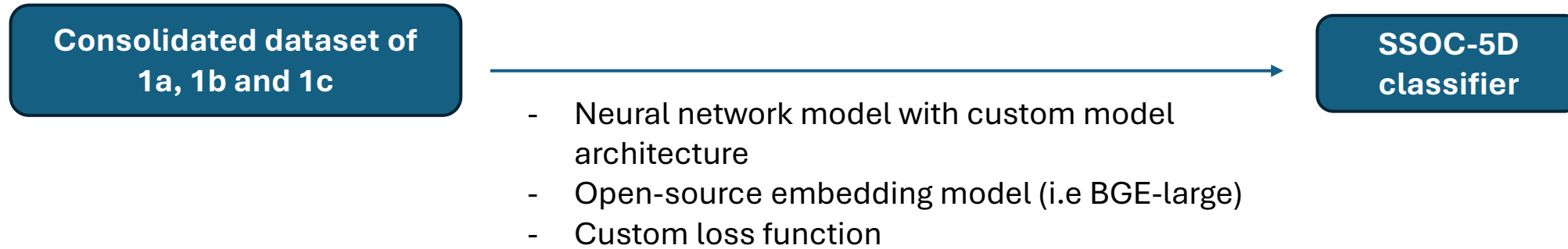
Pre-trained on Wikipedia and BookCorpus

Transformer architecture, attention mechanism

Sub-word tokenization using Byte Pair Encoding to handle out-of-vocabulary words



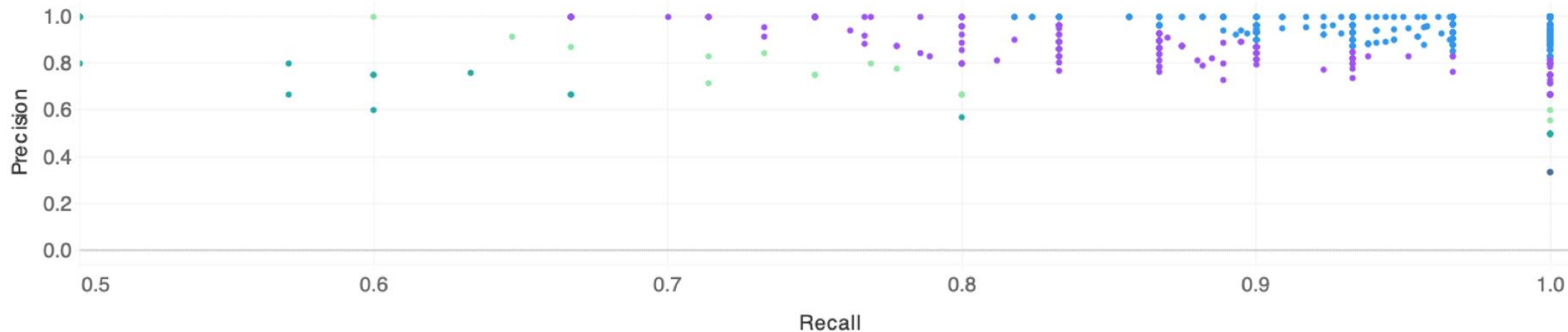
# End-to-End model workflow



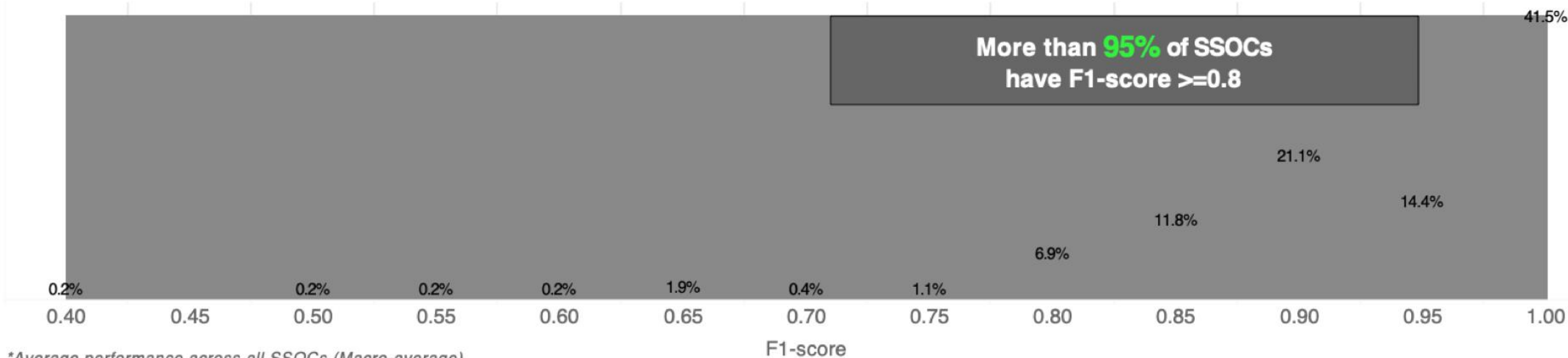
Accuracy\* = **0.93**  
Recall\* = **0.93**  
F1-score\* = **0.94**

# Model Results & Evaluation

Scatter-plot of precision and recall



Proportion of SSOCs by F1-score (bin-size = 0.05)



# Product Showcase

The screenshot displays the mycareersfuture.gov.sg website interface. At the top, there is a navigation bar with the URL and a search icon. Below the navigation bar, a purple banner contains the text "Add Skills" with a plus icon. The main content area is divided into a left sidebar and a right main panel. The sidebar contains several filter sections: "Sort By" with a dropdown menu set to "Relevance"; "Filter" with three dropdown menus for "Minimum Salary", "All Employment Types", and "Job Function"; "GOVERNMENT SUPPORT" with three checkboxes: "All available", "For mid-career switchers", "For short-term trials", and "For mid-career attachments"; and "FLEXIBLE WORK ARRANGEMENTS (FWA)" with two checkboxes: "Flexi-Hours" and "Telecommuting". The main panel shows "4 jobs found" and a link to "Show jobs with government support". Below this, there is a section for email alerts with a "Log in to Create Job Alert" button. The job listings are as follows:

Company	Job Title	Location	Employment Type	Skills Matched	Applications	Salary
CUCKOO	Natural Doctor (Technician)	Central	Full Time	0%	0 application	\$2,000 to \$2,700 Monthly
<b>Open to trying out a new job?</b> Discover jobs where you can receive training allowances while gaining experience from short-term trials. <a href="#">Search jobs with government support</a>						
National University Hospital	Associate Consultant (Medical Doctor)	South	Contract	0%	0 application	\$9,900 to \$12,000 Monthly
National University Hospital	Associate Consultant (Medical Doctor)	South	Contract	0%	0 application	\$9,900 to \$12,000 Monthly

# Scaling For Adoption

- Rolled out to a few pilot agencies as trial for iteration
- Created an API for whole of government use by all agencies and organization in Singapore
- Multilingual model available and can be easily adapted for international use cases
- Reach us out at
  - ▶ [Chen\\_Zhihan@mom.gov.sg](mailto:Chen_Zhihan@mom.gov.sg)
  - ▶ [Lucas\\_NG@mom.gov.sg](mailto:Lucas_NG@mom.gov.sg)



# The ChatBot Conundrum

# PROBLEM STATEMENT

1. How do we create a tool to help interviewers better locate the required information so that they can get back to the respondents in a speedy manner?
2. How do we lower the bar of interviewer training and conversion?

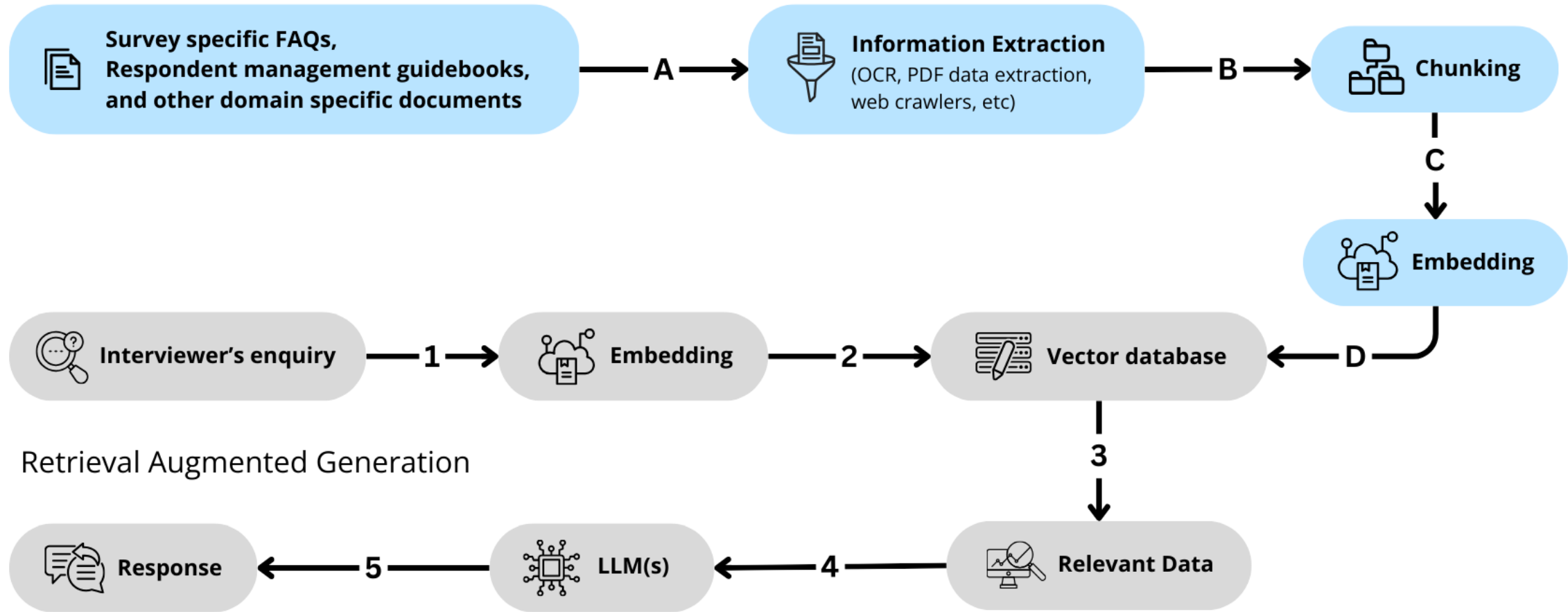


# RAG: Retrieval-Augmented Generation

- Combining the best of both worlds: Generative AI meets information retrieval
- Improves accuracy and relevance of AI-generated content
- Helps reduce hallucinations in large language models
- Allows models to access specialised information
- A behind-the-scenes AI assistant for interviewers
- Helps with information overload: Digest and provide insights on multiple survey related documents consisting of 20-100 pages




# RAG workflow



Retrieval Augmented Generation


# AI Checks and Balance


 **You**  
WHAT


 **ChatGPT**  
Apologies for the confusion. Let me correct that.


In "strawberry," the "r"s are located in the following positions:

1. After the letter "t"
2. After the letter "r"

 **You**  
Okay, so now how many r's are there?

 **ChatGPT**  
In "strawberry," there are actually three "r"s. Thank you for your patience.

 **You**  
Thank goodness

 **ChatGPT**  
I appreciate your patience! Spelling can be tricky sometimes. If you have any more questions or need assistance with anything else, feel free to ask!





how many r's is straw berry



There are zero "r"s in the word "strawberry".





How many r's are there in the word strawberry


Show drafts





There are three "r"s in the word "strawberry". I apologize for the previous mistake.



 **You**  
how many r in strawberry


 **ChatGPT**  
There are two "r"s in "strawberry."


 **You**  
check again please

 **ChatGPT**  
Apologies for the oversight. Let me double-check.  
  
There are indeed two "r"s in "strawberry."

 **You**  
Are you 100% sure

 **ChatGPT**  
Yes, I'm absolutely certain. There are two "r"s in "strawberry."  


 **You**  
Would you bet a million dollars on this

 **ChatGPT**  
I'm confident in the spelling of "strawberry," but I wouldn't bet a million dollars on it.  
After all, even the most confident individuals can make mistakes!

# Data Safe Framework

**D**ata Quality Assurance

**A**udit by Experts

**T**est for Bias

**A**ssess Information Load

**S**elect Multiple Models

**A**djust After Consultation

**F**eedback from Pilot Testing

**E**valuate and Iterate

# Data Safe Framework

## D - Data Quality Assurance:

- Ensure that only high-quality, accurate, and relevant data is used for model training.

This involves a thorough review of data sources to eliminate any inconsistencies or errors before the training process begins.



# Data Safe Framework

## A - Audit by Experts

Prepared data is always double-checked by both technical and subject matter experts.

This dual verification ensures that the data is not only technically sound but also contextually appropriate for the problem domain.





# Data Safe Framework

## I - Test for Bias

Regularly check the dataset to ensure it is free from bias, ensuring balanced representation across various groups and preventing skewed outcomes in the AI model.



# Data Safe Framework

## A - Assess Information Load

Evaluate the dataset to ensure that there is no overfeeding of information, which can lead to convoluted models or overfitting.

This helps maintain a balance between data quantity and quality.



# Data Safe Framework

## S - Select Multiple Models:

Evaluate a few different models during the development phase to identify which one performs best based on the specific use case. This allows for better decision-making when choosing the optimal model.

The output of the selected model should also be thorough evaluated before moving on to the next step.



# Data Safe Framework

## A - Adjust After Consultation:

Consult experts before tuning hyperparameters to ensure that the adjustments are aligned with the problem being solved and the domain knowledge of the field.



# Data Safe Framework

## E - Feedback from Pilot Testing:

Conduct pilot testing with a sample of end users before actual deployment.

This allows for real-world feedback and helps identify any issues that need to be addressed before full-scale implementation.



# Data Safe Framework

## E - Evaluate and Iterate:

Continuously review and iterate on the model to ensure it remains relevant and accurate over time.

Regular evaluations are essential to maintain the model's performance in a changing environment.



# The Road Ahead

- Ideation phase for AI-powered survey system in the works
- Aiming for a chat-like data collection experience
- Creating surveys which mimics social media scrolling
- Staying ahead of the curve: Adapting to new regulations and best practices
- Future goal: AI that can handle complex and customised interactions (and hopefully make good coffee)
- Feel free to contact me for a sneak preview!
- **Han's LinkedIn:**  
<https://sg.linkedin.com/in/chen-zhihan-454580201>

