



Amazon Sales Chatbot

Phase 3: Final Presentation

Presented by

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Natural Language Processing

Background

- AI is increasingly popular and utilized across industries because AI has the potential to decrease operational expenses and enhance customer satisfaction.
- Sales chatbots are particularly advantageous for E-commerce due to their ability to provide immediate assistance and offer personalized recommendations based on customer preferences.
- Therefore, our focus is on developing a sales chatbot for Amazon to implement NLP knowledge in practical applications.

Problems

- **High Operational Costs:** Relying solely on human sales representatives can be expensive due to the need for salaries, benefits, and training.
- **Limited Availability:** Outside regular hours of human sale can lead to missed sales when customers seek assistance on the website without receiving a response.
- **Delayed Responses:** customers might have to wait for a human representative to become available to address their queries, leading to frustration and potential abandonment of the purchase process.
- **Differences in human skills:** Variability in sales staff expertise can lead to inconsistent performance, affecting sales stability and making it challenging to maintain steady levels.

Solutions

We should develop a sales chatbot for the following reasons:

- **Cost Efficiency:** Implementing a chatbot reduces operational costs associated with human sales representatives, including salaries, benefits, and training expenses.
- **24/7 Availability:** A chatbot provides 24/7 availability, ensuring that customers receive immediate assistance even outside of regular business hours, thus preventing missed sales opportunities.
- **Instant Responses:** With a chatbot, customers receive instant responses to their inquiries, eliminating delays and potential frustration during the purchase process.
- **Consistent Sales Performance:** A chatbot ensures consistent sales interactions regardless of individual salesperson expertise, helping to maintain a steady level of sales.

Architecture of the Solution

- Data Source and Preprocessing
- NLP
 - Classification Part
 - LLM Part
- Evaluations for the system's performance
- Web Design

Expected results

- Classification model has at least 80% accuracy.
- The chatbot can answer basic queries, and handle irrelevant questions.
- Chatbot responses are related to user queries and can respond within a short time.

Methodology



Our Data Source

Dataset information :

- Classification model
 - Train dataset - <https://github.com/amazonqa/amazonqa?tab=readme-ov-file>
- Language Model
 - Amazon product dataset (extracted from meta data) - <https://huggingface.co/datasets/McAuley-Lab/Amazon-Reviews-2023>

Classification Model

- We have trained 3 models (biLSTM, CNN, and BERT) on different parameters with small (500 questions per product category) and large dataset (2000 questions per product category) with 17 classes since we saved the model when the validation loss is improved. Therefore, we select the best model with specific parameter based on minimum validation loss.
- We tried to reduce the number of classes from 17 to 10 classes to see the trend of improvement. we got CNN with 50 filters as our best model based on training time and minimum validation loss.

Classification Model

We trained CNN model with 50 filters with larger dataset (10000 questions per product category) in 10 classes , 9 classes, 7 classes , and 5 classes.

The performance of CNN on validation set:

- On 10 classes, the model got 1.413 on validation loss and around 52.9% validation accuracy
- On 9 classes, the model got 1.349 on validation loss and around 54.5% validation accuracy
- On 7 classes, the model got 1.136 on validation loss and around 59.8% validation accuracy
- On 5 classes, the model got 0.986 on validation loss and around 63.1% validation accuracy

We selected the CNN with 50 filters and 5 classes as our best model

Classification Model

For evaluation, we tested CNN model with 50 filters and 5 classes with test set and the model got around 61.5% accuracy

```
test_loss, test_acc = evaluate(model, test_loader, criterion, test_loader_length)

print(f'Test Loss: {test_loss:.3f} | Test Acc: {test_acc*100:.2f}%')
```

```
Test Loss: 1.014 | Test Acc: 61.49%
```

Language Model

Data Processing

The data was downloaded using the `generate_meta.py` script, designed to fetch and preprocess metadata for further use.

The script segments data into three subsets containing 100, 500, and 1000 products per category.

Due to hardware limitations, only the subset with 100 products per category was utilized for creating vector stores.

These vector stores facilitate efficient retrieval by converting textual data into numerical embeddings that can be quickly accessed during the query phase.

Language Model

Vector Stores Creation

The processed data was stored in vector stores using the FAISS library to facilitate efficient similarity searches.

This setup is crucial for the Retrieval-Augmented Generation (RAG) component of the project, which retrieves relevant product information to answer queries.

Language Model

Pretrained Models

The models tested include:

- **T5 Model:** fastchat-t5-3b-v1.0 from Hugging Face
- **GPT-2 Model:** GPT2-span-head-few-shot-k-16-finetuned-squad-seed from Hugging Face
- **FLAN T5 Models:** Base and large versions from Google's FLAN T5 aimed to leverage few-shot learning capabilities for better generalization.

Language Model

Experimentation and Logging

- Experiments were managed using the `mlflow_testing.py` script with configurations logged via MLflow to track different settings and outcomes

Test Dataset:

- question-answer pairs from the Amazon QA dataset, available at [GitHub - Amazon QA](#). The `generate_qa.py` script was employed to process this dataset into a suitable format for testing.

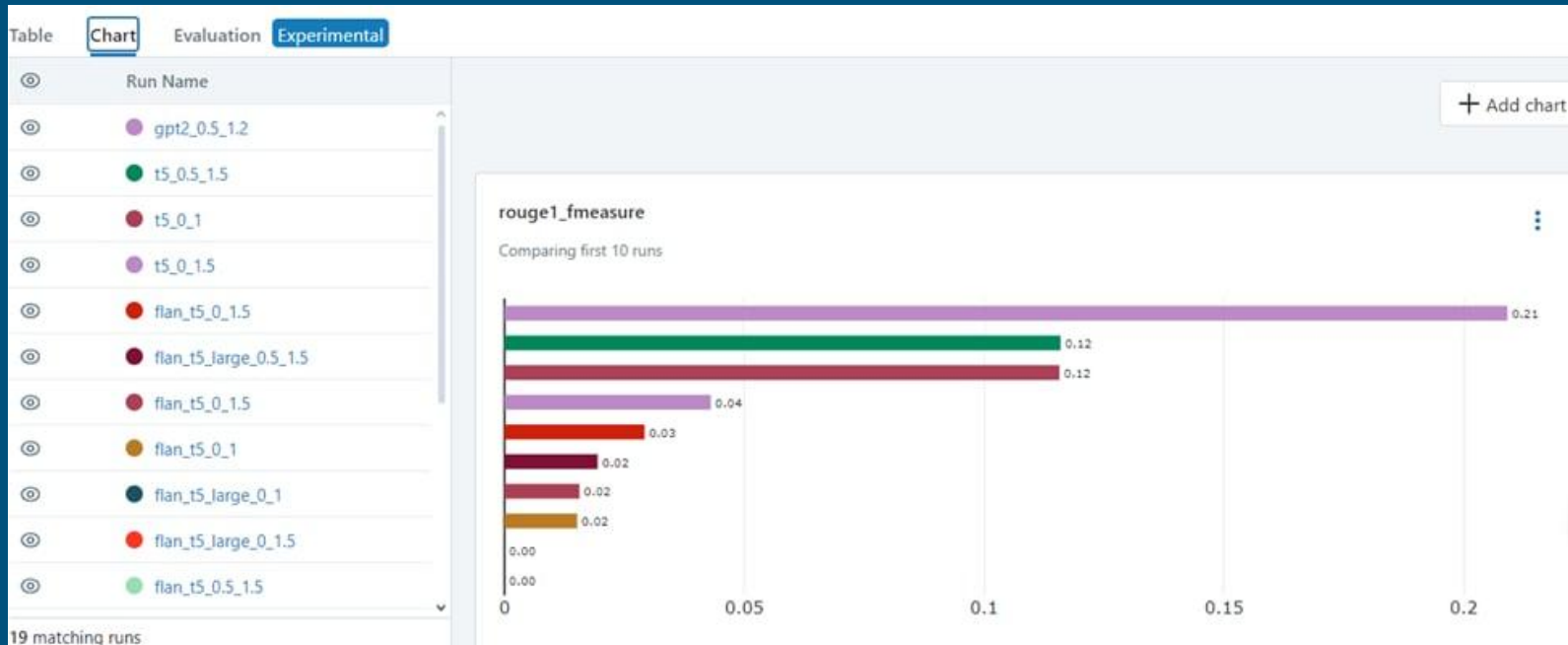
Language Model

Experimentation Result:

Table		Chart	Evaluation	Experimental			
						Metrics	
<input type="checkbox"/>		Run Name	Created	Duration	rouge1_fmeasur	rouge1_precision	rouge1_recall
<input type="checkbox"/>		gpt2_0.5_1.2	1 day ago	14.3s	0.209090909...	0.273809523...	0.169117647...
<input type="checkbox"/>		t5_0.5_1.5	1 day ago	3.5min	0.115942028...	0.307692307...	0.071428571...
<input type="checkbox"/>		t5_0_1	1 day ago	3.5min	0.115702479...	0.388888888...	0.067961165...
<input type="checkbox"/>		t5_0_1.5	1 day ago	3.3min	0.043010752...	0.4	0.022727272...
<input type="checkbox"/>		flan_t5_0_1.5	11 minutes ago	17.4s	0.029197080...	0.666666666...	0.014925373...
<input type="checkbox"/>		flan_t5_large_0.5_1.5	2 minutes ago	32.8s	0.019417475...	1	0.009803921...
<input type="checkbox"/>		flan_t5_0_1.5	7 minutes ago	13.0s	0.015625	1	0.007874015...
<input type="checkbox"/>		flan_t5_0_1	6 minutes ago	13.0s	0.015151515...	1	0.007633587...
<input type="checkbox"/>		flan_t5_large_0_1	2 minutes ago	17.3s	0	0	0

Language Model

Experimentation Result:



Language Model

Evaluation Metric:

The primary evaluation metric used was the ROUGE-1 F-measure.

- for evaluating NLP chatbot performance in LangChain projects
- The F-measure, which balances precision and recall, is crucial for assessing how well the model captures relevant content (recall) while avoiding superfluous generation (precision).
- This balance is key in chatbot applications where accurate and succinct answers are valued.

Language Model : Result Discussion

Overview of Results:

- The experiment involved several runs of different configurations of the GPT-2, T5, and FLAN T5 models with varying temperature (temp) and repetition penalty (rep) parameters.
- The evaluation metrics focused on ROUGE-1 scores (Precision, Recall, F-measure)

Language Model : Result Discussion

Result Analysis:

- Performance Across Models:
 - GPT-2 and T5 configurations showed varying effectiveness.
 - Temperature and repetition penalty critically affected performance.
- Specific Insights:
 - Higher temperature values led to higher recall but lower precision.
 - High repetition penalties decreased overall performance.
- Hypothesis Validation:
 - Adjusting parameters optimizes precision-recall trade-off.
 - Optimal settings depend on model architecture.
- Limitations:
 - Limited computational power and model capacity.
 - Balancing precision and recall remains a challenge.
- Insights:
 - Experimentation highlights nuances of model configuration.
 - Larger models show potential for higher precision.

Web Design

Amazon Sales Chatbot

I want mobile phone cover.

"Cell Phone Car Mount, Magnetic, Universal, Black",
"average_rating": 4.5, "rating_number": 7, "features": ["Universal -
small magnetic attachment affixed to your cell phone or cover,
fits all cell phones", "Mount Anywhere"]

Send

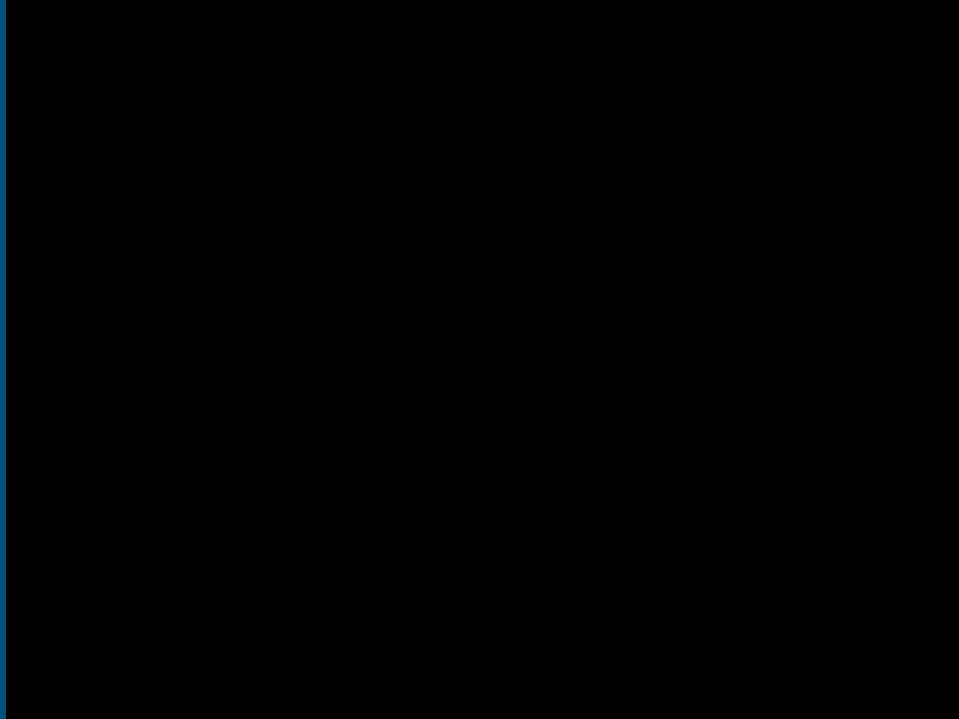
Product Information

Cell Phone Car Mount, Magnetic, Universal, Black
Price: None
Rating: 4.5 (7 ratings)
Features:

- Universal - small magnetic attachment affixed to your cell phone or cover, fits all cell phones
- Mount Anywhere - secure to any flat surface of your choosing for optimal visual advantage while driving, or at your desk
- Great for the home, office, RV, motorcycle.

- Technology
 - Backend (Flask): Handles user interactions and chatbot responses.
 - Frontend (HTML/JS): Provides a user-friendly chat interface.
 - Use “**flan_t5**” model for quick response and superior result.
 - Used model can be changed by updating the model name and its hyperparameters.
- Functionality
 - Allows users to type messages (Type your message...), send them, and receive responses from the chatbot.
 - Messages are displayed in a visually distinct format, with user messages on the right and bot responses on the left.
- Additional Sections
 - Displays information for up to 4 products, including:
 - Product title
 - Price
 - Rating
 - Features

Amazon Sales Chatbot Demo



Amazon Sales Chatbot

I want mobile phone cover.

"Cell Phone Car Mount, Magnetic, Universal, Black",
"average_rating": 4.5, "rating_number": 7, "features": ["Universal - small magnetic attachment affixed to your cell phone or cover, fits all cell phones", "Mount Anywhere"]

Type your message...

Send

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- Great for the home, office, RV, motorcycle.
- Heavy duty with a sleek design, a must have accessory.

HTC Vivid Black/Blue Perforated Cover

Price: None

Rating: 5 (2 ratings)

Features:

- Combines hard plastic material and soft silicone together which feels great and protects your device from scratches

Fishfinder, Depth Finder Poly Sun Cover for 3" - 4" Models - Protects Your Screen from Sun / Weather Damage

Price: 10.99

Rating: 4.4 (86 ratings)

Features:

- Made of poly material

- Made of poly material
- Available in black
- Drawstring
- For 3-4 inch models
- Measures 9 inches (23cm) x 6" (115cm) x 3" (8cm)

AUGUR Travel Laptop Backpack

Price: None

Rating: 2.9 (2 ratings)

Features:

- →MULTIPURPOSE: Ideal for daily use at school, work, weekend getaway, occasional travel, overnight camping, hiking, and great gifts to everyone you love
- →PRACTICAL & CONVENIENT: rugged handle with steel cable on the top for easy carrying.Side COMPRESSION STRAPS keep the versatile backpack at whatever size you requires
- →EXTERNAL DIMENSION & PREMIUM MATERIAL: Laptop sleeve fits most 14 inches laptops or Macbook. Made from high quality 1200 D Oxford Cloth fabric with high density 210 D PU fabric for better TEAR & WATER RESISTANT
- →LARGE CAPACITY & ORGANIZED: Independent pockets with classic style for large storage and organization.3 spacious main compartments and many hidden pockets can accommodate lots of accessories, like clothes, cellphone, wallet, stationery, notebook, keys; 2 side larger deep ZIPPER POCKET for easy access essentials,2 side elastic net pockets are convenient for holding umbrellas or water bottles
- →COMFORTABLE: Back U-shaped three-dimensional ventilation

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- →COMFORTABLE: Back U-shaped three-dimensional ventilation design help for the air convection, ventilation and heat elimination. Comfortable wide breathable mesh shoulder straps with plentiful sponge pad help relieve the stress from your shoulder. Both sides of the shoulder strap with lanyard design, can hang sunglasses and other small pendants

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- Measures 9 inches (23cm) x 6" (15cm) x 3" (8cm)

Amazon Sales Chatbot

I want mobile phone cover for iphone

"title": "HTC Vivid Black/Blue Perforated Cover", "average_rating": 5.0, "rating_number": 2, "features": ["Combines hard plastic material and soft silicone together which feels great and protects your device from scratches"], "description":

I want mountain bike

"What size do you need?"

Type your message...

Huffy Women's Granite Bike

Price: None

Rating: 3 (2 ratings)

Features:

- Versatile, affordable mountain bike available in two models--24-inch wheels and 26-inch wheels
- 15-speed bike with thumb shifter on the handlebar for quick selection of gears
- Knobby tires for excellent traction, linear pull brakes
- Durable frame is made of steel
- Assembly required

AM Universal Aluminum Alloy MTB Bike Handlebar Bar End Plugs for 22-24mm Handlebar Caps 2pcs

Price: None

Rating: 4.2 (24 ratings)

Features:

- Brand Meroca
- Material AL6061 Aluminum alloy cap + plastic
- Suit for handlebar inside diameter >=17mm(more than 17mm)
- Srew specification M4*34mm
- Weight about 19g

WOG2008 Bike seat Oversized Comfortable Bicycle Saddle Replacement Wide Bike Cushion with Dual Shock Absorbing Rubber Ball Universal Wide Bicycle Saddle, with Reflective Strap

Product Information

EUROBIKE Mountain Bike,21 Speed Full Suspension Mountain Bike, 27.5" Mens or Women Bicycle,27.5 Mountain Bikes for Adult(E7 3 Spoke mag Wheels Orange)

Price: 269.0

Rating: 4 (264 ratings)

Features:

- **【Shimano 21 Speed Professional Mountain Bike】** Shimano shifters combines with the rear Shimano derailleurs to deliver gear changes easy and smooth, for uphill Climbing, downhill riding, or pure acceleration, to keep you pushing through any terrain in your path. 3 gears front derailleur and 7 gears derailleur deliver 21 speeds of ultra smooth shifting
- **【Dual Disk Brake】** Dual front and rear mechanical disc brake giving you the stable and strong braking force and help you stop confidently in all conditions
- **【High Carbon Steel Frame & Anti-skid Tires】** The 18" sturdy frame, mountain bike frame and excellent welding technology make it a sturdy and durable cruise bike. The anti-skid tires for mountain bikes have a super excellent anti-skid function, it has a strong grip and reduces wear and tear, so it can also be used on rainy days.
- **【Full Suspension mountain bike】** Dual suspension frame and suspension fork soak up bumps and thumps to provide you a durable riding experience. This MTB can challenge mountain,

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Price: None

Rating: 4.4 (20 ratings)

Features:

Thank you
For your attention