The Art and Science of Data

Navigating the Data Science Lifecycle

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Learning Outcomes

- Understanding of the data science and machine learning lifecycle
- Understanding of the key considerations in navigating a data science lifecycle
- Preliminary insights into underlying architecture that powers a data science solution
- Comprehension of different job roles coming together to deliver these solutions

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Agenda

- Building data-driven solutions – a strategic view
- Business Context - E-commerce
- An example solution - Chatbot
- Data Science solution lifecycle – deep dive

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How are Data-driven solutions typically built?

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Business Context - E-commerce

- Product selection struggle
- Difficult navigation of web page
- Inadequate support

- Poor shopping experience
- Poor customer satisfaction
- High cart abandonment rate

- Track orders

- 24*7 support

- Product analytics

- Search for products

- Assist with FAQs

- Nudge to complete sales

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Strategy for building the ChatBot

"If you were owning this business, what teams would have to come together to build this solution?"

You would need someone to -

- Create the UI of the chatbot and integrate it into your website.
- Create a language based model to answer your customers' questions.
- Create/gather and manage the data that is needed to train your model.
- Deploy that model, monitor it and manage it's performance.
- Manage and drive the development & consumption of this product.

F.E - 80%

B.E - data

10-20%

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A Typical Solution Lifecycle

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Scoping/Problem Definition

"What should this ChatBot be able to do/how would it work?"

What kind of questions related to orders do we want the chatbot to answer?

How should this chatbot behave for different kinds of requests/what actions should it take based on inputs?

How would we measure impact? What are the business KPIs and who are the stakeholders?

On what platform should we build this chatbot? What is the tech infrastructure needed to support this solution at scale?

What language model should we use to build this solution? What should it be trained on and how?

How do we monitor the performance of this chatbot? How will be deployed to be made available to the user?

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Gather Data

"What data do I need to build this chatbot?"

User data

- Customer details
- Browsing
- Purchase History

Product data

- Product Brand
- Product type
- Model type

Orders data

- Order ID
- Payment Type
- Order quantity

- Payment Methods
- Product availability
- Refund/Return

FAQ

- Product quality
- Service rating
- Delivery rating

Feedback

- Pending orders
- Dispatched orders
- Returned orders

Shipping

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Prepare Data

"How do I create the data I need for my data solution/product?"

Various databases within a data warehouse like **MySQL**

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Exploratory Data Analysis

"How should I approach exploring my data?"

- What is the user's intent?
- What product/service is being referred to?
- What are the data sources for this query?

insights

- Common pain points for customers
- Feedback on chatbot performance
- Key product/service features

Data Cleaning → **Formulate Questions** → **Data Analysis** → **Conclusions** → **Documenting Insights**

- Removing/ treating missing values
- Treating outliers
- Variable conversion

Univariate Analysis

Distribution

Bi/multivariate Analysis

- The most frequent services opted for in each category
- Improvements to make based on the findings

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Data Pre-processing

	Input	Input type
User Input to chatbot →	When will my order be delivered ?	Order Status

How does the chatbot understand us?

I want to buy a new HP Laptop	Make a purchase	Intent Recognition
I want to buy a new HP Laptop	Product - new Laptop	Entity Recognition
I want to buy a new HP Laptop	Brand - HP	Named Entity Recognition
I want to buy a new HP Laptop	Sentiment - Positive	Sentiment Analysis

This is how a machine understands - This is a customer, who seems to have an overall positive sentiment, and wants to purchase a new HP laptop.

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Data Pre-processing

	Input	Input type
User Input to chatbot →	When will my order be delivered ?	Order Status

Data Pre-processing steps

When	will	my	order	be	delivered	?	Tokenization
When	will	my	order	be	deliver	?	Lemmatization
When	will	my	order	be	deliver	?	Stop Word Removal

Time

order xxn

delivery

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$f = a_1 x_1 + a_2 x_2 + \cdots + a_n x_n$

i/p

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Training & Tuning

Model Training

Labeled Dataset = **Input Query** + **Desired Response from Chatbot**

- **Rule based Chatbots**
- **Generative Chatbots**
- **Retrieval Chatbots**

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Training & Tuning

"Hyperparameters control the behavior of the model during training."

Train

Test

improve/ optimize "parameters"

Model Tuning

- Learning Rate
- Hidden Layers
- Dropout Rate
- Batch Size

- Grid Search
- Random Search

Hyperparameter tuning involves testing different combinations of hyperparameters and selecting the combination that offers the best performance.

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Performance Evaluation

pattern..

Model Testing

Using **Validation/Test Dataset** that is different from training data.

Sep'21 → model

Evaluation

Human — Validate & label

Generalize — Well on new examples

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Model Deployment

"How am I able to get the real time response for my queries?"

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Model Monitoring

Date	C-ID	Category	Query	Response	Satisfied

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"Leadership"

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Measuring Impact

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Summary

ART ⇒ interpretation – comm – decision making "judging"

1. Data science lifecycle is a cycle needing collaboration across teams and stakeholders
2. ML lifecycle is contained within Data Science lifecycle
3. Art is to define problems, get the right data, take right decisions during the lifecyle and the right final recommendations for deployment and improvement
4. Science is to be able to code the algorithms, extract patterns & insights and deploy the solutions

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Happy Learning !

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