



Natural Language Meets Database: System Transparency and User Understanding in NL-to-SQL Translation

Parssa Jashniah, Jacob Ortenberg, Thivyan Sivananthan



Have you ever had difficulties with search queries on Amazon or similar platforms when looking for products? If you did, what did this result in?

- Many difficulties when searching for specific products, i.e., technical products
- Switch to another platform (eBay -> Amazon)



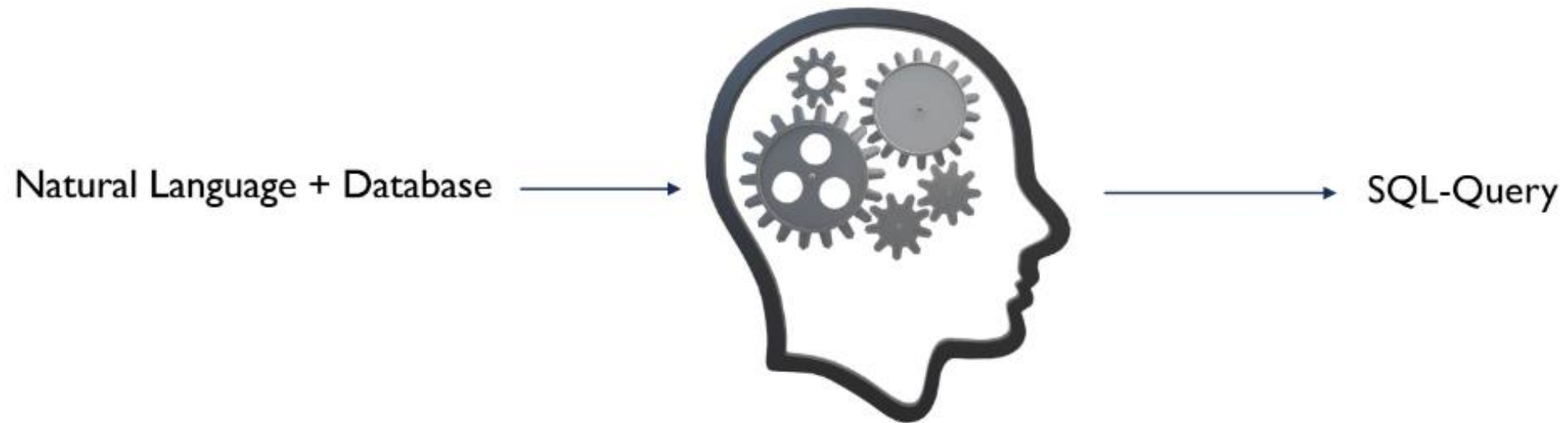
Have you ever had difficulties with search queries on Amazon or similar platforms when looking for products? If you did, what did this result in?

- Many difficulties when searching for specific products, i.e., technical products
- Switch to another platform (eBay -> Amazon)

Where could these difficulties come from?

- Search behavior is individual
- ~ 50/50 generic vs. specific search behavior

Motivation



Generate SQL Query

Turn everyday language into queries.

Instruction

Get customers with most rentals this year

Generate query



Database schema

Databases ▾

Add

actor,actor_id,smallint
actor,first_name,varchar
actor,last_name,varchar
actor,last_update,timestamp
actor_info,actor_id,smallint
actor_info,first_name,varchar
actor_info,last_name,varchar



```
SELECT
    c.customer_id,
    c.first_name,
    c.last_name,
    COUNT(r.rental_id) AS rental_count
FROM
    rental r
JOIN
    customer c ON r.customer_id = c.customer_id
WHERE
    EXTRACT(YEAR FROM r.rental_date) = EXTRACT(YEAR FROM CURRENT_DATE)
GROUP BY
    c.customer_id, c.first_name, c.last_name
ORDER BY
```

Developer Tool

Generate SQL Query

Turn everyday language into queries.

Instruction

Get customers with most rentals this year

Generate query



Database schema

Databases ▾

Add

actor,actor_id,smallint
actor,first_name,varchar
actor,last_name,varchar
actor,last_update,timestamp
actor_info,actor_id,smallint
actor_info,first_name,varchar
actor_info,last_name,varchar



```
SELECT
    c.customer_id,
    c.first_name,
    c.last_name,
    COUNT(r.rental_id) AS rental_count
FROM
    rental r
JOIN
    customer c ON r.customer_id = c.customer_id
WHERE
    EXTRACT(YEAR FROM r.rental_date) = EXTRACT(YEAR FROM CURRENT_DATE)
GROUP BY
    c.customer_id, c.first_name, c.last_name
ORDER BY
    rental_count DESC
```

Developer Tool

OUR GOAL: Better search results for Websites

Generate SQL Query

Turn everyday language into queries.

Instruction

Get customers with most rentals this year

Generate query

Database schema

Databases ▾

Add

actor,actor_id,smallint
actor,first_name,varchar
actor,last_name,varchar
actor,last_update,timestamp
actor_info,actor_id,smallint
actor_info,first_name,varchar
actor_info,last_name,varchar

```
SELECT
  c.customer_id,
  c.first_name,
  c.last_name,
  COUNT(r.rental_id) AS rental_count
FROM
  rental r
JOIN
  customer c ON r.customer_id = c.customer_id
WHERE
  EXTRACT(YEAR FROM r.rental_date) = EXTRACT(YEAR FROM CURRENT_TIMESTAMP)
GROUP BY
  c.customer_id, c.first_name, c.last_name
ORDER BY
```

Trial & Error



Local model + DAIL-Schema

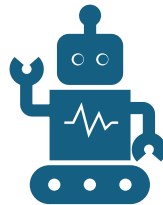
Limited computational resources

Trial & Error



Local model + DAIL-Schema

Limited computational resources



Switch to Claude-API

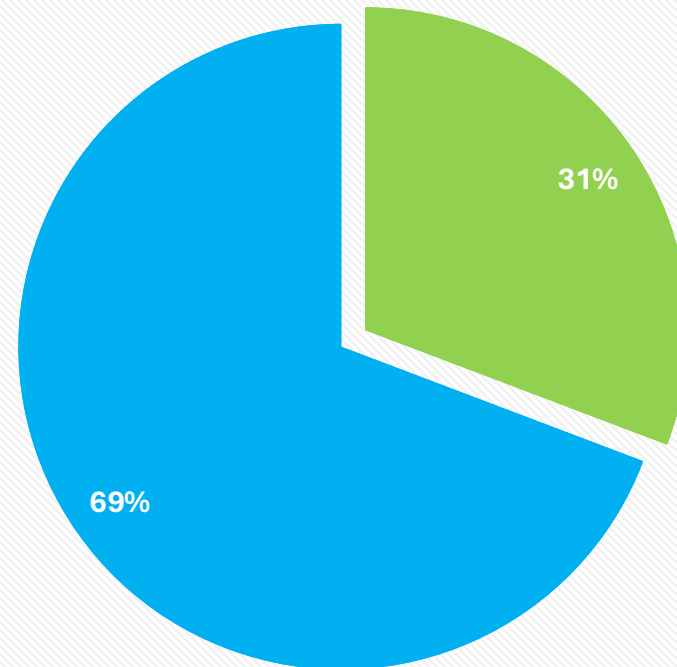


**Accuracy high enough for our project
-> DAIL-Schema**



Demo-Time

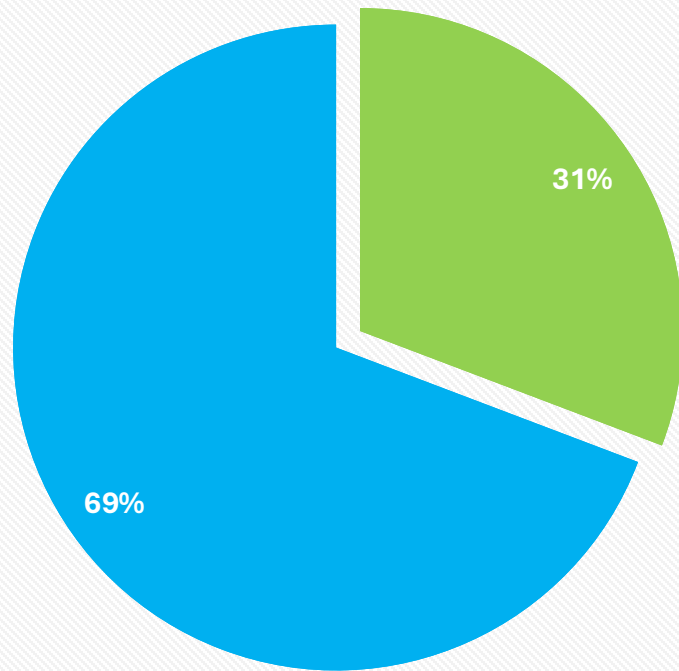
I was satisfied with the AI results



■ Very satisfied ■ Satisfied ■ Neutral ■ Dissatisfied ■ Very dissatisfied

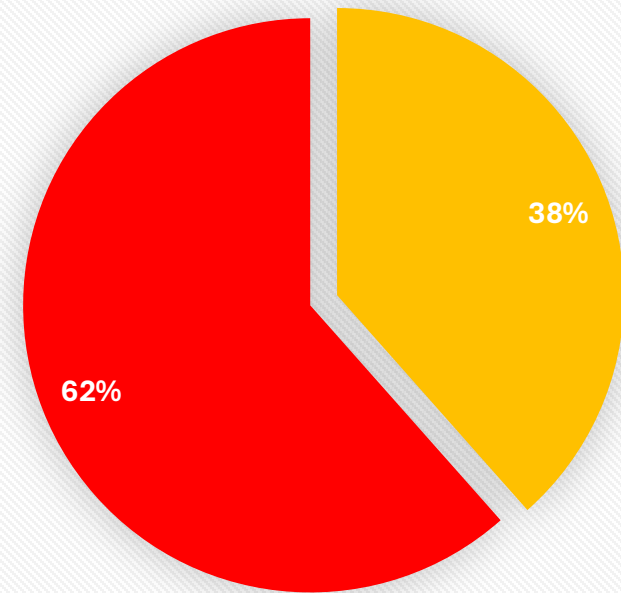
Possible filter bias

I was satisfied with the AI results



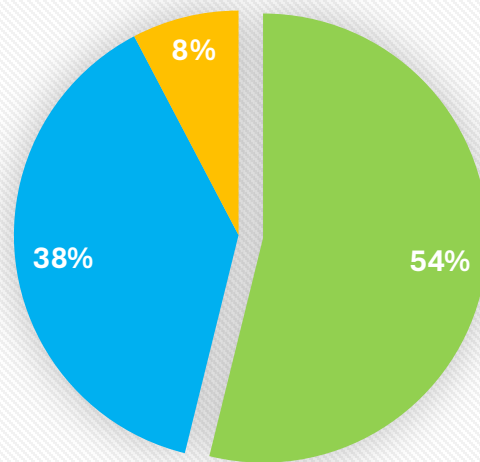
Very satisfied Satisfied Neutral Dissatisfied Very dissatisfied

I was satisfied with the Conventional search system results



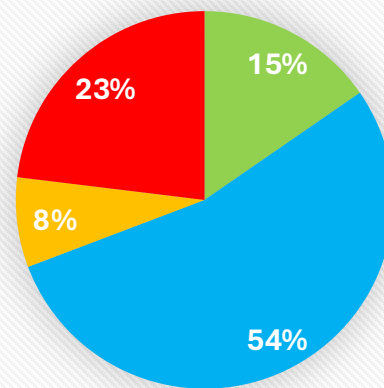
Very satisfied Satisfied Neutral Dissatisfied Very dissatisfied

I felt like the AI could handle complex search queries



Strongly agree Agree Neutral Disagree Strongly disagree

If I knew if there was an intelligent system, then I could do without any filters



Strongly agree Agree Neutral Disagree Strongly disagree

Results

- To narrow down the search results, did you use the filters or did you alter the search query more often?
 - Expectation: 50/50



Results

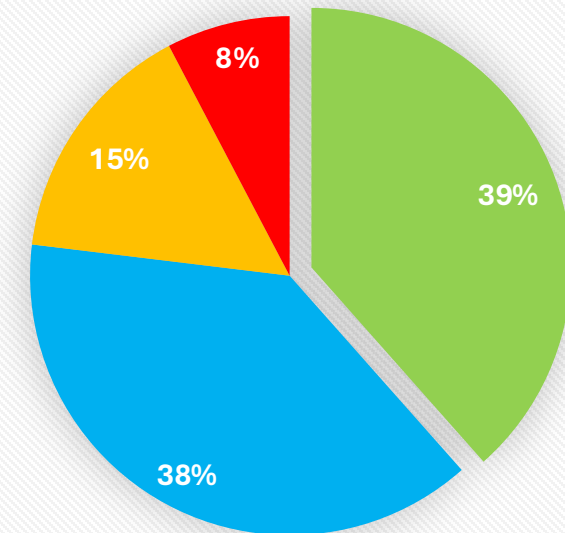
- To narrow down the search results, did you use the filters or did you alter the search query more often?
 - Expectation: 50/50
 - Reality:
 - More complex
 - Some people still prefer the filters
 - Many switch entirely to AI (after trying many queries -> trust)
 - Some used 50/50



Results

- Possible correction mechanisms
 - Highlight implicit used filter visually
 - Highlight features in search queries that would result in an empty set visually

It was easy for me to correct the search query if the initial search result was not satisfactory

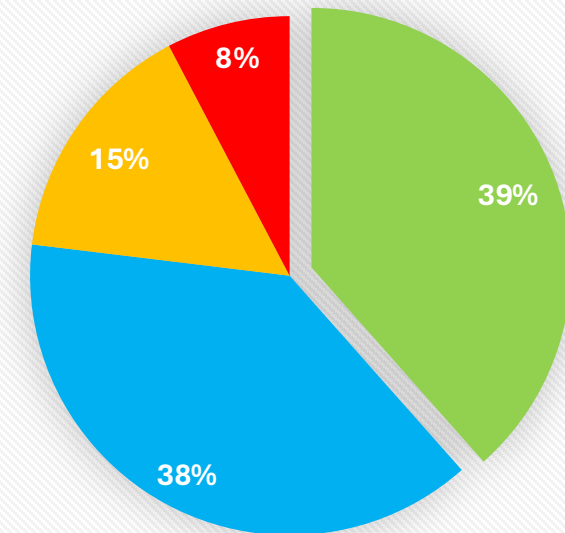


■ Strongly agree ■ Agree
■ Neutral ■ Disagree
■ Strongly disagree

Results

- Possible correction mechanisms
 - Highlight implicit used filter visually
 - Highlight features in search queries that would result in an empty set visually
 - When too few search results are found, append similar results
 - Pop-up if the search query generates by the AI, has high uncertainty
 - Auto suggestions to the query

It was easy for me to correct the search query if the initial search result was not satisfactory



■ Strongly agree ■ Agree
■ Neutral ■ Disagree
■ Strongly disagree



Closing question: Would you recommend this system to others?

Hit or miss?

Closing question: Would you recommend this system to others?

HIT!!!



Thank you for
your Attention

