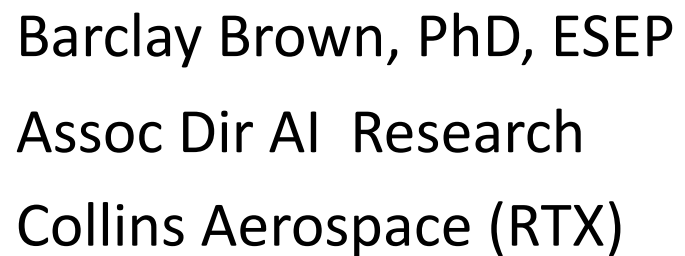


A vibrant, fantastical landscape featuring a large, colorful, textured sphere (resembling a planet or moon) in the sky, a bright sun or star on the horizon, and a foreground filled with numerous small, colorful, rounded objects (possibly planets or moons) and tall, thin, spiky structures.





Putting Gen AI to Work

- Level I: Simple Q&A
 - Prompt / response
 - Prompt engineering
 - Persona
 - Templates
 - Detailed instructions
 - Retrieval-Augmented Generation
 - Live supply of info (copy/paste)
 - Vectorization of your data
 - Retrieval of relevant information
 - Prompting of LLM
 - Application design
 - Multiple prompting hidden from user
 - LLM as a component / function
 - Combining other elements



(generated by Microsoft Designer)



Quick Quiz: Chat-No-GPT

- Write a family Christmas poem, including some inside jokes
- Write an effective cover letter for a job application
- Choose between several business ideas based on which will be more successful
- Analyze a project proposal as to its feasibility, budget reasonableness and value
- Summarize a set of project status updates into a brief executive summary
- Check a document to see if it meets a set of written standards for that kind of document
- Write a plan for a project
- Write a good, usable legal brief on a novel subject
- Generate a small database of 100 made-up people, with addresses and phone numbers



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Deep Trek: A Custom GPT

Always wanted to captain the Enterprise? Fascinated by chatGPT? If you have a chatGPT plus subscription, I'd love for you to try my latest experiment, Deep Trek. It's not a game--think of it more like a virtual universe, with you as captain of the Enterprise. You just jump into the adventure by either requesting a mission from Star Fleet Command, or by setting your own stage with a Captain's Log entry (just like in the series). Take it wherever you want it to go. It has knowledge of the original series (Capt. Kirk) and even more on the next generation series (Capt. Picard) so you can choose your ship and crew or even mix them. Ask Data and Spock to work together on something? No problem. Refer to or ask for research on anything previously seen, or head off in your own direction. Make first contact with alien species, make friends, collaborate on projects, enhance the ship. Try anything. Here's the full link or just search Deep Trek in the custom GPT area of chat.openai.com.

28-janv.-24

www.incose.org





An exercise: Your Resume

Barclay R. Brown, Ph.D., ESEP

Phone: +1 302-272-5291

barclay@barclaybrown.com

Summary

- ☐ Technical Leadership in Generative AI Applications across large organizations
- ☐ AI, Data Science, and Machine Learning Systems Research, Development, and Application
- ☐ Deep Industry Experience: Aerospace and Defense and Systems Engineering
- ☐ Communication and Technical Presentation; accomplished public speaker, author
- ☐ Hands on practitioner: Python, Machine Learning, Data Science, Systems Engineering

Education / Certification

Ph.D., Industrial and Systems Engineering, University of Central Florida, Orlando, FL

M.A., Psychology, State University of West Georgia, Carrollton, GA
Intelligence. He has been a keynote speaker at prestigious events such as the IBM Systems Engineering Agile Summit.

did Barclay Brown ever work for a defense company in Germany

ChatGPT

I do not have specific information about Barclay R. Brown's employment history beyond the information provided in the profile you provided. As of my last knowledge update in September 2021, there was no information available about him working for a defense company in Germany. Please note that his employment history might have changed since then, and I do not have access to real-time or updated information. If you require the most current information about his career, you may consider conducting an online search or contacting relevant organizations directly for verification.

User

did barclay brown ever work for a defense company

ChatGPT

Yes, according to the information provided in the profile you initially shared, Barclay R. Brown has experience in the Aerospace and Defense industry. His professional experience includes roles such as an Associate Director for Artificial Intelligence Research at Collins Aerospace/RTX and an Engineering Fellow in Systems Engineering at Raytheon Technologies. These roles indicate his involvement with defense companies in the aerospace and defense sector. However, I do not have information about specific defense companies he may have worked for beyond what is mentioned in the profile.



Write a Christmas poem in the style of "Twas the night before Christmas" and include the following people: Larry and Dorothy his wife, Bill, Hazel; Honor and Barclay--a couple, Professor Kim--a man, Also include the following organizations and concepts: INCOSE (an organization), QMI (an educational institution), Vocational certainty, zero defects attitude, personal authenticity, executive credibility, and the phrase "one worm".

'Twas the night before Christmas, and in a quaint little town,
Larry and Dorothy, husband and wife, settled down.
With dreams of their friends, Bill, Hazel, and more,
They awaited the magic, for 'twas Christmas, for sure.

Honor and Barclay, a loving, happy pair,
In their cozy abode, they had not a care.
Their hearts filled with joy as they snuggled up tight,
For Christmas was coming, and it felt just right.

Professor Kim, a wise man with knowledge so vast,
Prepared for the holiday, his lessons unsurpassed.
In the warmth of his home, by the soft candlelight,
He pondered on wisdom through the long winter's night.

INCOSE, an organization, dedicated and true,
Worked hard all year through, with tasks to pursue.
With a zero defects attitude, they strived to excel,
In shaping a world where great stories would dwell.

QMI, an institution of learning so grand,
Taught vocational certainty, a guide to understand.
With personal authenticity and executive flair,
They nurtured young minds with utmost care.

If it please the Court...

Write a legal brief, citing relevant cases on the issue of whether a passenger in a car can be held partially liable as the cause of a crash

<https://chat.openai.com/share/3a7a9db5-b333-430a-8373-83b9c80018c7>



The image part with relationship ID rld18 was not found in the file.

LLM as a Component in a System or Application

The following numbered items are responses to the question, "In your own words (not restating vision or mission), what do you think of when you think about what the work of INCOSE should be?" Please summarize these in a list, giving more emphasis to concepts mentioned in more than one response. Use no more than ten items in your list and no more than 200 words in your response. <survey responses>

- Not necessary to turn over the entire application to the LLM
- Consider small tasks that an LLM can perform as part of larger application
 - Summarizing input text from a database or survey
 - Composing a reply, notification, or other message to users
 - Creating an introduction to a diverse set of information

(Survey Question: In your own words (not restating vision or mission), what do you think of when you think about what the work of INCOSE should be?)

1. Advancing Systems Engineering: By enhancing the discipline, its application, and expanding its body of knowledge. This involves moving from a process-focus to an outcome-focus, and making it more effective in solving real-world problems (1, 3, 5, 6, 11, 13, 21, 23).
2. Global Influence: Promoting Systems Engineering globally, addressing 21st Century's challenges, and facilitating its advance worldwide (2, 6, 12, 17, 22).
3. Tackling Societal Issues: Using Systems Engineering to address societal problems and promote sustainable use of resources (7, 9, 15).
4. Supporting Systems Engineers: Through community building, professional development, and practical support, providing clear guidance to engineer systems (10, 16, 20, 31).
5. Outreach: Expanding the awareness and promoting the value of Systems Engineering across all industries and domains (4, 8, 14).
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10. Practical Guidance: Providing practical guidance in systems design, impact assessment and to address complex challenges (26, 27).

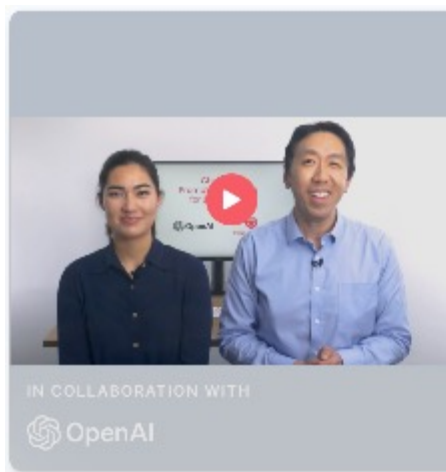
Let the LLM do what it does best



The image part with relationship ID rld18 was not found in the file.

Prompt Engineering

- Give clear and specific instructions
 - Use delimiters to indicate distinct parts of input
 - Ask for structured output
 - Ask the model to check whether conditions are satisfied
- Give the model “time to think”
 - Proceed step by step
 - Give procedural instructions
- Refine prompts iteratively
 - Vary adjectives
 - Refine the persona



ChatGPT Prompt Engineering for Developers

Go beyond the chat box. Use API access to leverage LLMs into your own applications, and learn to build a custom chatbot.

- Learn prompt engineering best practices for application development
- Discover new ways to use LLMs, including how to build your own chatbot
- Gain hands-on practice writing and iterating on prompts using the OpenAI API

Beginner to Advanced

Isa Fulford, Andrew Ng

Prerequisite recommendation: Basic Python

Enroll For Free

Learn more

Example: Preparing for a Panel

- Prompt: you are an expert on sustainability in systems, and on systems thinking and systems engineering, and also an experienced and engaging talk show host. Please generate preparation materials for a talk show on the concept of sustainability in systems, with panelists from major manufacturing companies and sustainability organizations. First, list ten major themes in sustainability in systems, with references to articles and books. Next, generate ten thoughtful and engaging questions to ask panelists about sustainability and systems that will generate interesting conversation.

Response: Ten Major Themes in Sustainability in Systems

Circular Economy

Reference: "Cradle to Cradle: Remaking the Way We Make Things" by William McDonough & Michael Braungart

Concept: The idea of designing systems that eliminate waste and promote the reusability of products.

Energy Efficiency

Reference: "The Fifth Fuel: Strategies for Sustainable Energy" by Alliance to Save Energy

Concept: Techniques and strategies for reducing energy consumption and improving energy utilization in systems.

Life Cycle Analysis

Reference: "Life Cycle Assessment: Principles and Practice" by Mary Ann Curran

Concept: The comprehensive examination of a product's environmental and social impacts throughout its entire life cycle.

Supply Chain Sustainability

Reference: "Sustainable Logistics and Supply Chain Management" by David B. Grant, Alexander Trautrim, and Chee Yew Wong

Concept: Addressing sustainability in every link of the supply chain, from procurement to distribution.

Corporate Social Responsibility (CSR)

Ten Thoughtful and Engaging Questions for Panelists

Circular Economy: How are your organizations transitioning towards a circular economy, and what challenges have you encountered? Energy Efficiency: Can you share some specific examples of energy-efficient systems you've implemented and their impact?

Life Cycle Analysis: How do you incorporate life cycle analysis into your product design and decision-making processes?

Supply Chain Sustainability: What sustainable practices are you incorporating into your supply chain to minimize negative environmental and social impacts?

Corporate Social Responsibility: Beyond compliance, how does CSR shape your business decisions and systems design?

...



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Example: formatted output

- Prompt: Consider the text below. Identify all common parts of speech in the text and create a table in json format with keys: word, part of speech. number of occurrences of the word. text: "Four score and seven years ago our fathers brought forth on this continent a new nation, conceived in liberty, and dedicated to the proposition that all men are created equal. "Now we are engaged in a great civil war, testing whether that nation, or any nation so conceived and so dedicated, can long endure. We are met on a great battlefield of that war. We have come to dedicate a portion of that field as a final resting place for those who here gave their lives that that nation might live. It is altogether fitting and proper that we should do this. "But in a larger sense we cannot dedicate, we cannot consecrate, we cannot hallow this ground. The brave men, living and dead, who struggled here have consecrated it, far above our poor power to add or detract. The world will little note, nor long remember, what we say here, but it can never forget what they did here. It is for us the living, rather, to be dedicated here to the unfinished work which they who fought here have thus far so nobly advanced. It is rather for us to be here dedicated to the great task



Sure, I can help you with that. Here's the JSON table with the identified words, their parts of speech, and the number of occurrences in the given text:

json

 Copy code

```
[
  { "word": "Four", "part_of_speech": "CD", "occurrences": 1 },
  { "word": "score", "part_of_speech": "NN", "occurrences": 1 },
  { "word": "and", "part_of_speech": "CC", "occurrences": 1 },
  { "word": "seven", "part_of_speech": "CD", "occurrences": 1 },
  { "word": "years", "part_of_speech": "NNS", "occurrences": 1 },
  { "word": "ago", "part_of_speech": "RB", "occurrences": 1 },
  { "word": "our", "part_of_speech": "PRPS", "occurrences": 2 },
  { "word": "fathers", "part_of_speech": "NNS", "occurrences": 1 },
  { "word": "brought", "part_of_speech": "VBD", "occurrences": 1 },
  { "word": "forth", "part_of_speech": "RB", "occurrences": 1 },
  { "word": "on", "part_of_speech": "IN", "occurrences": 1 },
  { "word": "this", "part_of_speech": "DT", "occurrences": 3 },
```


Asking the model to check its own results



The best move for 'O' is to take position 5, the center of the board. This is the optimal move as it blocks 'X' from having a chance to win in the next move through the diagonal (positions 3, 5, 7). The updated board would look like:

markdown

Copy code

```
X | O | X
-----
- | O | -
-----
X | - | O
```

The numbers corresponding to the board positions would look like:

mathematica

Copy code

```
1-X, 2-O, 3-X, 4-empty, 5-O, 6-empty, 7-X, 8-empty, 9-O.
```

Regenerate

BA i'll take position 4 for X

Alright, if 'X' is placed in position 4, the board now looks like this:

markdown

Copy code

```
X | O | X
-----
X | O | -
-----
X | - | O
```

The numbers corresponding to the board positions would look like:

mathematica

Copy code

```
1-X, 2-O, 3-X, 4-X, 5-O, 6-empty, 7-X, 8-empty, 9-O.
```

With this move, 'X' has created two possible winning lines (vertical and diagonal), and 'O' must block one of them in the next move.

BA Is the game over

My apologies for the oversight. Yes, you're correct. The game is indeed over. With the placement of 'X' in position 4, 'X' has three in a row vertically on the leftmost column (positions 1, 4, 7). This is a winning condition for Tic-Tac-Toe.

Here is the final board for clarity:

Regenerate

Learn how to “talk” to LLMs through practice

Let's Proceed Step by Step



- Explain as you would to an intelligent but inexperienced human
- Step by step instructions are very helpful
- Use delimiters to differentiate instructions from source material

```
text = f"""
In a charming village, siblings Jack and Jill set out
a quest to fetch water from a hilltop \
well. As they climbed, singing joyfully, misfortune \
struck—Jack tripped on a stone and tumbled \
down the hill, with Jill following suit. \
Though slightly battered, the pair returned home to \
comforting embraces. Despite the mishap, \
their adventurous spirits remained undimmed, and they
continued exploring with delight.
"""

# example 1
prompt_1 = f"""
Perform the following actions:
1 - Summarize the following text delimited by triple \
backticks with 1 sentence.
2 - Translate the summary into French.
3 - List each name in the French summary.
4 - Output a json object that contains the following \
keys: french_summary, num_names.

Separate your answers with line breaks.

Text:
```{text}```
"""

response = get_completion(prompt_1)
print("Completion for prompt 1:")
print(response)
```


# Using a Prompt and Response Templates

**Free-form emails come in requesting registration in a course. Use LLM to extract the important information**

**From:** Tre [REDACTED]  
**Sent:** Wednesday, September 6, 2023 11:05 AM  
**To:** Barclay Brown [Barclay.Brown@incose.net](mailto:Barclay.Brown@incose.net)  
**Subject:** SEQM QMI Training

Hello, [REDACTED]  
My name is [REDACTED] would like to sign up  
for the SEQM QMI training course cohort. I'm a new member of the  
working group and INCOSE, excited to learn more!

Thanks,  
TM



```
{
 'reg': 'yes',
 'Fn': 'T [REDACTED]',
 'Ln': 'M [REDACTED]',
 'Member': [REDACTED],
 'Email': '[REDACTED]@gmail.com',
 'emdate': '09/06/2023'
}
```

```
messages = [{"role": "system", "content": "You are an AI
assistant that helps people find information."}, \n {"role": "user", "content": "consider the email delimited by
triple backticks. Extract the following \n items into a python dictionary in the following format.
Show only the python dictionary--do not \n include any other messages or text: reg (yes or now): Is
the email requesting to register in a course?; \n Fn: What is the registrant's first name?; Ln: What is the
registrant's last name?; \n Member Number: What is the registrant's member
number?; \n Email: What is the registrant's email address?; emdate:
What date was the email sent? format mm/dd/yyyy; \n \"\"\" + emailtext + \"\"\" }],
```

**Ask for what you want—you might just get it!**

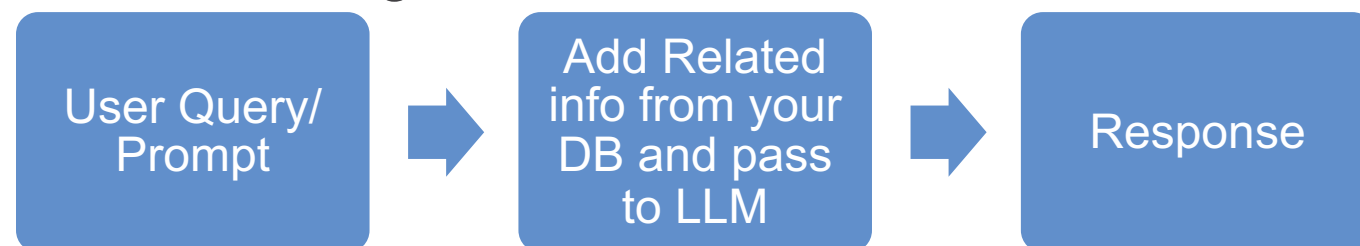
# Retrieval Augmented Generation: *An LLM Application Pattern*

- Find source material
- Create index and store
- Take user prompt, and search for related information in index
- Pass search results along with prompt to LLM
- The indexer calls an type of LLM to build the index, **so KNOW where your data is going!**
- Indexers may use commercial embedding models like
- Llama-index can also work with open source and downloaded LLMs

## LLM Chat



## Retrieval-Augmented Generation



## Building your DB





# Building a DB of information for RAG



- Collect documents in common formats
  - Pdf
  - Text
  - Word
- Use loaders, like those from the LangChain library, to load documents into memory structures
- Split documents into chunks to allow granular retrieval (also from LangChain)
  - Split by separator
  - Recursive splitter
- Create embedding vectors for each chunk and store in a vector database (e.g. ChromaDB)
- Persist Vector DB on disk for future runs
- Rebuild index when source docs are added or updated

Collect Documents

Use Loaders

Split Docs

Split By Separator

Recursive Splitter

Create Embedding Vectors

Persist Vector DB

Rebuild Index

(Illustration created by GPT-4 in using svg output format)

# BACKUP

# Hiring Trained Animals:

*Generative AI Patterns and Practices for Systems Engineering*

Barclay R. Brown, Ph.D., ESEP  
Assoc. Dir. AI Research  
Collins Aerospace  
INCOSE CIO  
[Barclay.brown@incose.net](mailto:Barclay.brown@incose.net)

*Image created using DALL-E2 with prompt, "an explorer in the style of starlord looking for artificial intelligence in a beautiful library laboratory with advanced machines and technology, digital art"*

28-janv.-24





# Key Concepts in LLM Applications



- LLM as component
- Prompt engineering
- Application Patterns
  - Multi-prompting
  - Retrieval-Augmented Generation
  - Deconstructing Data





# LLM as a Component in a System or Application



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**(Survey Question: In your own words (not restating vision or mission), what do you think of when you think about what the work of INCOSE should be?)**

1. Advancing Systems Engineering: By enhancing the discipline, its application, and expanding its body of knowledge. This involves moving from a process-focus to an outcome-focus, and making it more effective in solving real-world problems (1, 3, 5, 6, 11, 13, 21, 23).
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Let the LLM do what it does best



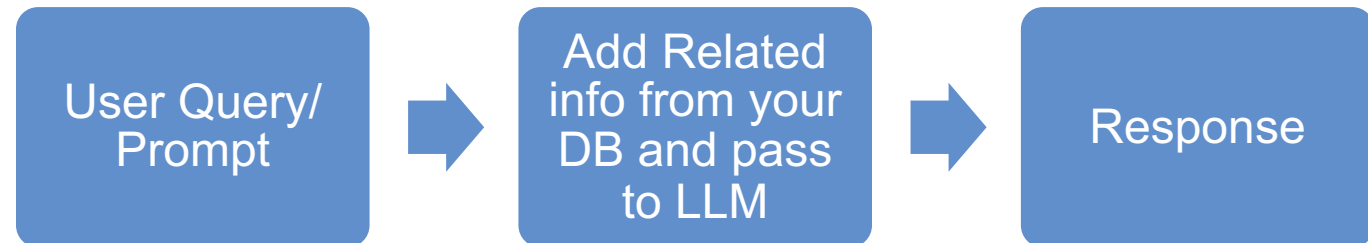
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## LLM Chat



## Retrieval-Augmented Generation



## Building your DB





# Destructuring Data

- Traditional thinking: structured data is better than unstructured for computer applications
- LLM thinking: LLMs understand natural language, but structured data may not carry the meaning in the structure in an obvious way
- Metaphor: Humans often need other humans to explain structured data, tables, plots, diagrams, etc. in natural language so they can understand
- Memo from LLM: maybe explain the data to me too!

**X-ref:** F30 Platform code includes M3 4dr Sedan (3.0L 6cyl Turbo 7A), M3 4dr Sedan (3.0L 6cyl Turbo 6M), M3 4dr Sedan (3.0L 6cyl Turbo 6M), 340i xDrive 4dr Sedan AWD (3.0L 6cyl Turbo 8A), ActiveHybrid 3 4dr Sedan (3.0L 6cyl Turbo gas/electric hybrid 8A), 340i 4dr Sedan (3.0L 6cyl Turbo 8A), 340i xDrive 4dr Sedan AWD (3.0L 6cyl Turbo 8A), 328d xDrive 4dr Wagon AWD (2.0L 4cyl Turbodiesel 8A), 340i 4dr Sedan (3.0L 6cyl Turbo 8A)...

B	C	D	E	DR	DS
Make	Model	Year	Trim (description)	Car classification	Platform code / generation number
BMW	3 Series	2018	M3 4dr Sedan (3.0L 6cyl Turbo 7A)	Compact car	F30, F31, F80
Ford	F-150	2021	Limited 4dr SuperCrew 4WD 5.5 ft. SB (3.5L 6cyl Turbo 350)	Full-size pickup tru (13th gen)	
Ford	F-150	2020	Limited 4dr SuperCrew 4WD 5.5 ft. SB (3.5L 6cyl Turbo 350)	Full-size pickup tru (13th gen)	
Ford	F-150	2021	Limited 4dr SuperCrew 5.5 ft. SB (3.5L 6cyl Turbo 350)	Full-size pickup tru (13th gen)	
BMW	3 Series	2012	M3 2dr Convertible (4.0L 8cyl 6M)	Compact car	E90, E91, E92, E93
Ford	F-150	2020	Limited 4dr SuperCrew 5.5 ft. SB (3.5L 6cyl Turbo 350)	Full-size pickup tru (13th gen)	
BMW	3 Series	2010	M3 2dr Convertible (4.0L 8cyl 6M)	Compact car	E90, E91, E92, E93
BMW	3 Series	2018	M3 4dr Sedan (3.0L 6cyl Turbo 6M)	Compact car	F30, F31, F80
BMW	3 Series	2008	M3 2dr Convertible (4.0L 8cyl 6M)	Compact car	E90, E91, E92, E93
BMW	3 Series	2016	M3 4dr Sedan (3.0L 6cyl Turbo 6M)	Compact car	F30, F31, F80
Ford	F-150	2021	Platinum 4dr SuperCrew 4WD 6.5 ft. SB (5.0L 8cyl Turbo 350)	Full-size pickup tru (13th gen)	
Ford	F-150	2021	Platinum 4dr SuperCrew 4WD 5.5 ft. SB (5.0L 8cyl Turbo 350)	Full-size pickup tru (13th gen)	
BMW	3 Series	2012	335is 2dr Convertible (3.0L 6cyl Turbo 6M)	Compact car	E90, E91, E92, E93
BMW	3 Series	2012	M3 2dr Coupe (4.0L 8cyl 6M)	Compact car	E90, E91, E92, E93
Ford	F-150	2021	King Ranch 4dr SuperCrew 4WD 6.5 ft. SB (5.0L 8cyl Turbo 350)	Full-size pickup tru (13th gen)	
Ford	F-150	2021	King Ranch 4dr SuperCrew 4WD 5.5 ft. SB (5.0L 8cyl Turbo 350)	Full-size pickup tru (13th gen)	
Ford	F-150	2021	Platinum 4dr SuperCrew 6.5 ft. SB (5.0L 8cyl Turbo 350)	Full-size pickup tru (13th gen)	
Ford	F-150	2020	Platinum 4dr SuperCrew 4WD 6.5 ft. SB (5.0L 8cyl Turbo 350)	Full-size pickup tru (13th gen)	
Ford	F-150	2021	Platinum 4dr SuperCrew 5.5 ft. SB (5.0L 8cyl Turbo 350)	Full-size pickup tru (13th gen)	
Ford	F-150	2020	Platinum 4dr SuperCrew 4WD 5.5 ft. SB (5.0L 8cyl Turbo 350)	Full-size pickup tru (13th gen)	
BMW	3 Series	2010	M3 2dr Coupe (4.0L 8cyl 6M)	Compact car	E90, E91, E92, E93
Ford	F-150	2020	King Ranch 4dr SuperCrew 4WD 6.5 ft. SB (5.0L 8cyl Turbo 350)	Full-size pickup tru (13th gen)	
BMW	3 Series	2021	M340i xDrive 4dr Sedan AWD (3.0L 6cyl Turbo 8A)	Compact car	G20
Ford	F-150	2021	King Ranch 4dr SuperCrew 6.5 ft. SB (5.0L 8cyl Turbo 350)	Full-size pickup tru (13th gen)	
BMW	3 Series	2006	M3 2dr Convertible (3.2L 6cyl 6M)	Compact car	E46
BMW	3 Series	2008	M3 2dr Coupe (4.0L 8cyl 6M)	Compact car	E90, E91, E92, E93
Ford	F-150	2020	Raptor 4dr SuperCrew 4WD (3.5L 6cyl Turbo 350)	Full-size pickup tru (13th gen)	
Ford	F-150	2020	King Ranch 4dr SuperCrew 4WD 5.5 ft. SB (5.0L 8cyl Turbo 350)	Full-size pickup tru (13th gen)	
Ford	F-150	2021	King Ranch 4dr SuperCrew 5.5 ft. SB (5.0L 8cyl Turbo 350)	Full-size pickup tru (13th gen)	
BMW	3 Series	2020	M340i xDrive 4dr Sedan AWD (3.0L 6cyl Turbo 8A)	Compact car	G20
Ford	F-150	2020	Platinum 4dr SuperCrew 6.5 ft. SB (5.0L 8cyl Turbo 350)	Full-size pickup tru (13th gen)	
BMW	3 Series	2004	M3 2dr Convertible (3.2L 6cyl 6M)	Compact car	E46
Ford	F-150	2020	Platinum 4dr SuperCrew 5.5 ft. SB (5.0L 8cyl Turbo 350)	Full-size pickup tru (13th gen)	

The 2018 BMW 3 Series M3 4dr Sedan (3.0L 6cyl Turbo 7A), is a compact car using platforms F30, F31 or F60... and is classified as a Compact Car...

Tell the LLM what the data means