

Integration of Generative AI Tools in Computer Science Research

Michael Heroux
Scientist in Residence
Department of Computer Science

ChatGPT as an Intellectual Companion



NEWS ARTICLES ON RISKS
VS. PERSONAL
EXPERIENCE



BENEFITS OF CHATGPT AS
AN INTELLECTUAL
PARTNER



IMPORTANCE OF
CONTEXT IN ASKING
QUESTIONS



REFINING REQUESTS FOR
MORE MEANINGFUL
RESPONSES

In my personal experience, ChatGPT and similar tools are excellent intellectual partners. I can converse about many topics, learn a lot, get new insight, and take the responses with some healthy skepticism. The conversation is not unlike one I would have with a colleague while at lunch or on a walk!

About Personas

AI inference engine is an under-constrained search space

Personas are an intuitive way to provide guidance

Personas effectively narrow the set of possible responses

Persona—a description of a real or imagined person—can effectively narrow the set of possible responses and improve their relevance.

Usage of Personas in R&D

Role in software
application
development

Personas guide
requirements,
design, and testing

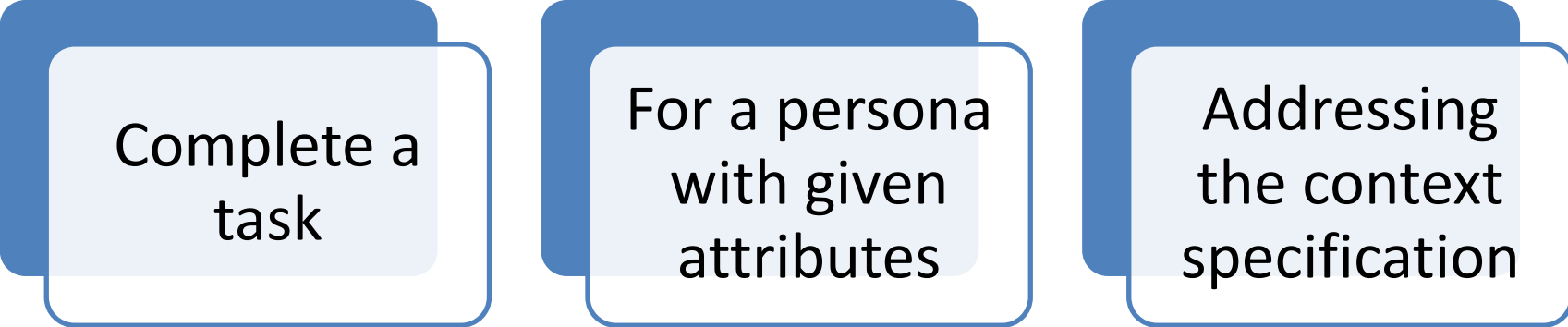
Matching product
features with user
needs

Role of Contexts

Provides task details and goals

Context ensures appropriateness and utility of responses

Scenarios: Using Personas with Contexts



Complete a
task

For a persona
with given
attributes

Addressing
the context
specification

Sample Scenarios

Scenario: Select a capstone project research topic. At the beginning of the semester, each student must determine a topic to serve as the foundation for their semester-long research project.

- **Student persona:** Each student will create a persona that describes their background, experience, and interests.
- **Context:** The research topic must satisfy course requirements

Scenario: Identify weak arguments in my paper.

- **Topic expert persona:** Preconditioned with reference content that conveys the domain of expertise. The student can use this persona to converse about topic details
- **Context:** Draft student paper, related peer-reviewed content

Scenario: Improve text clarity through efficient word use. One theme of the capstone course is efficient use of text. Word count reduction has strong correlation with improved technical prose clarity.

- **Efficient-text editor persona:** Singular purpose persona that focuses on reducing word count while retaining the same meaning
- **Context:** Set of strategies for reducing word count (could be generated by ChatGPT too)

Scenario: Suggest capstone course research topic

---- Copy and paste into ChatGPT 4.0 text window (<https://chat.openai.com/?model=gpt-4>) ----

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Persona

Name: Mike Herman

Coursework: Intro to computer science, software development, algorithms, computer organization, databases, computer ethics, agile software development, differential and integral calculus, intro psychology, intro social science

Interests: Computer gaming, chess, baseball, new ideas in technology

Things I don't find interesting: Cooking, sophisticated movies, loud music

Context

A good research topic must positively answer the following questions:

1. Does it have a significant computer science component? (Does it require your computer science background to do the research?)
2. Are there sufficient high-quality resources at your disposal?
3. Is it an active field in the computer science community?
4. Can I develop a demonstration or prototype capability in this topic area?
5. Is there intellectual substance to this topic?

Task: Generate a list of possible research topics I could pursue for my semester-long capstone course in computer science

ChatGPT 4.0 Response

Certainly, Mike! Based on your coursework, interests, and the provided context, here's a list of research topics that might align with your requirements for your semester-long capstone course:

1. AI in Computer Gaming:

- Significant computer science component: AI and Machine Learning algorithms.
- Resources: Game engines, AI frameworks
- Active field: Continual development in AI and gaming
- Prototype: Develop an AI-driven non-player character in a game
- Intellectual substance: Exploration of cognitive behaviors, decision-making, and learning techniques

2. Algorithmic Trading Strategies in Baseball Player Performance Prediction:

- Significant computer science component: Data analysis, algorithms
- Resources: Publicly available baseball statistics, machine learning libraries
- Active field: Sports analytics
- Prototype: Implement a predictive model for player performance
- Intellectual substance: Statistical modeling, algorithm development

3. Quantum Computing in Chess Algorithms:

- Significant computer science component: Quantum computing, algorithms
- Resources: Quantum development kits, chess databases
- Active field: Quantum computing
- Prototype: Implement a quantum chess-playing algorithm
- Intellectual substance: Quantum mechanics, algorithmic complexity

4. Blockchain Technology for Secure Data Management in Databases:

- Significant computer science component: Cryptography, databases
- Resources: Blockchain platforms, database systems
- Active field: Data security
- Prototype: Develop a blockchain-secured database
- Intellectual substance: Security measures, decentralization

5. Ethics and Bias in AI Algorithms:

- Significant computer science component: AI, Ethics
- Resources: AI frameworks, literature on ethics
- Active field: AI ethics, bias detection
- Prototype: Develop a bias-detection system
- Intellectual substance: Ethical considerations, algorithm fairness.

6. VR/AR Applications in Agile Software Development Environments:

- Significant computer science component: Virtual Reality/Augmented Reality, Software Development
- Resources: VR/AR development tools, agile methodologies
- Active field: Agile development, human-computer interaction
- Prototype: Create a VR/AR tool for agile project management
- Intellectual substance: Human interaction, software engineering principles

7. Personalized Education through Machine Learning:

- Significant computer science component: AI, personalized learning
- Resources: Educational datasets, machine learning frameworks
- Active field: EdTech, AI in education
- Prototype: Develop a personalized learning algorithm
- Intellectual substance: Learning theory, algorithm design

These topics should provide a rich ground for exploration, aligning with your background and interests in computer science, and satisfying the requirements outlined for your capstone course.

Goal for the Semester

Exploration and
cataloging of
personas

Using personas as
virtual
embodiments for
specific tasks

Establishing a
collection of
research advisors
for assistance

Final Note



We will embrace
generative AI tools in
this course

You must take
responsibility for the
content of your papers
& presentations

Generative AI tools can
only be used to
accelerate the finding
and learning process,
not replace it