Social Control Copilot

# Introduction

In an era where digital transformation is reshaping industries, social media has emerged as a central platform for communication, influence, and promotion. The rapid growth of social platforms has created new opportunities for brands, businesses, and influencers to engage with their audiences and drive growth. As the need for personalized, efficient, and scalable strategies increases, artificial intelligence (AI) tools have become crucial for optimizing social promotion efforts. One such tool, the copilot for social promotion, leverages advanced AI technologies to assist in the creation, management, and evaluation of social campaigns.

This research paper explores the application of copilot technology in social promotion, focusing on its ability to automate content generation, audience targeting, and campaign optimization. The paper examines how AI-driven copilots can support marketers in navigating the complexities of social media algorithms, consumer behavior, and engagement metrics. Additionally, it addresses the ethical considerations and potential challenges of relying on AI for promotional activities in a highly competitive and fast-paced digital environment. By analyzing the effectiveness of copilot tools, this study aims to provide insights into how they can enhance the efficiency and success of social promotion campaigns across various platforms.

Through a combination of theoretical exploration and practical case studies, this chapter seeks to contribute to the growing body of knowledge on AI’s role in transforming digital marketing strategies and its impact on the future of social promotion.

In the ever-evolving landscape of social media promotion, the integration of AI tools has become a game-changer. In this context, the social media manager assumes the role of the captain, guiding campaigns, crafting strategies, and interpreting data to drive engagement and growth. Meanwhile, the AI acts as the copilot, providing invaluable support in navigating the complexities of the digital space, optimizing content creation, and enhancing campaign performance. Much like a captain and copilot work in tandem to ensure a successful flight, the collaboration between human expertise and AI technology forms a powerful partnership that maximizes the potential of social promotion efforts.

By leveraging AI tools, social media managers can unlock new opportunities for more efficient, personalized, and impactful campaigns. These tools assist in everything from content generation to audience segmentation, streamlining processes and improving overall results. Eager & Brunton (2023), Xu (2024), and (Su and Yang 2023) study the transformative role of AI copilots in education, focusing on how tools such as ERNIE Bot (PRNewswire 2023), ElevenLabs, and Classpoint can enhance the effectiveness of teaching strategies. Although applications of copilots in self-driving cars, education, retail (Furmakiewicz et al 2024), health (Chiam et al 2024, Zou et al 2024) and other domains has been thoroughly explored, it is not the case for social promotion domain.

In this chapter we introduce A Social Promotion Copilot (SPC) for the optimization of social campaigns, drive engagement, and empower brands to navigate the digital landscape with greater agility and success. SPC is also a part of a customer relationship management pipeline (Galitsky 2021) supporting communication with a customer, customer retention and handling complaints. Moreover, SPC can be an assistant in individual social promotion in professional and personal domains.

## Social promotion of new products

A significant portion of a firm's efforts is dedicated to introducing new products and technologies to the market. However, these initiatives come with substantial risks, as launching a new product is inherently unpredictable. The initial market penetration phase is particularly critical, as it sets the trajectory for the product’s future adoption. A rapid and widespread takeoff can provide a competitive edge, trigger viral consumer adoption, and ultimately determine whether the product succeeds or fails (Golder & Tellis, 2004; Mahajan & Muller, 1979).

To navigate these uncertainties, promotional strategies play a crucial role in accelerating early diffusion. By strategically deploying marketing efforts—especially promotional campaigns—companies can stimulate initial demand, generate awareness, and create momentum that drives product adoption. Effective promotional activities not only help overcome market inertia but also maximize exposure, encourage early adopters, and establish a foundation for long-term success.

A Social Promotion Copilot (SPC) can significantly enhance these promotional efforts by leveraging AI-driven automation, real-time data analysis, and personalized engagement to optimize product launches. By monitoring consumer sentiment, identifying key influencers, and tailoring promotional content to specific audience segments, SPC ensures that marketing messages reach the right people at the right time. It can dynamically adjust campaign strategies based on real-time feedback, ensuring that promotional efforts remain relevant and impactful throughout the diffusion process. Additionally, SPC can automate interactions, fostering engagement across social platforms and amplifying word-of-mouth effects. By streamlining and optimizing promotional activities, a Social Promotion Copilot increases the likelihood of a successful product takeoff, reduces the risk of launch failure, and maximizes the efficiency of marketing investments.

# Copilot for social promotion

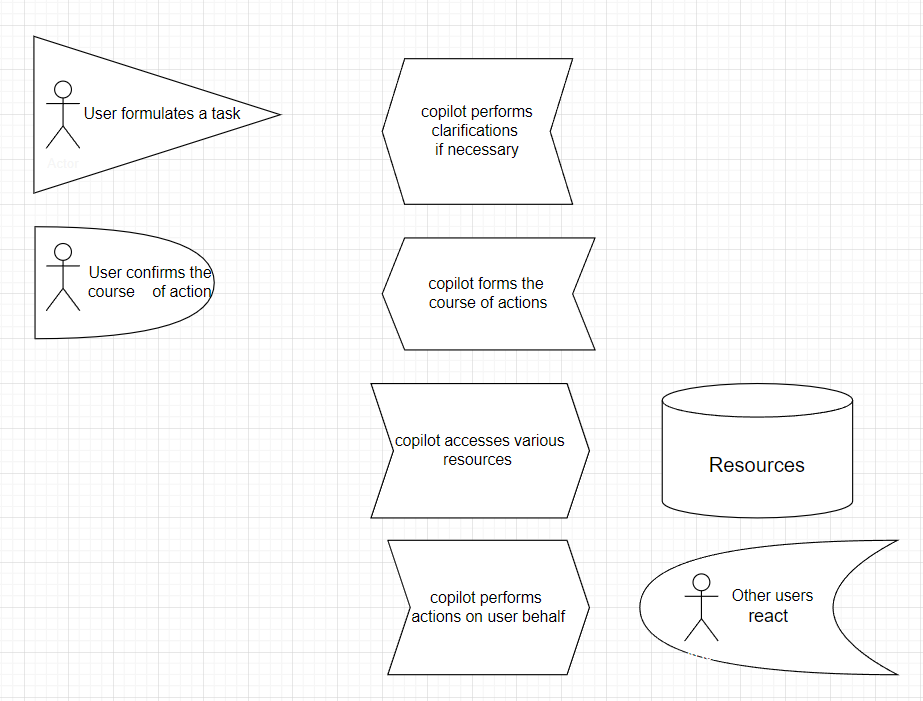


Fig … Social Promotion Copilot: AI-Powered Content Amplifier

The Social Promotion Copilot is an AI-driven tool designed to enhance visibility, engage audiences, and automate content distribution across social media platforms. It assists users in crafting optimized posts, analyzing engagement, and suggesting strategies for better outreach.

The users provide a raw idea or draft (e.g., "Promote my new blog post about AI trends"), and the copilot enhances and optimizes the post for different platforms:

* 1. Twitter/X: Concise, engaging with hashtags → *"🚀 AI is transforming industries! Check out the latest trends in my new blog: [link] #AI #FutureTech"*
  2. LinkedIn: Professional and thought-leadership style → *"The AI landscape is evolving rapidly. In my latest article, I explore key trends shaping the future. Read more: [link]"*
  3. Instagram/Facebook: Visually engaging, story-driven → *"AI is the future! Swipe to see the latest trends. Full article here: [link] 📲🔥 #ArtificialIntelligence #TechNews"*

The copilot supports auto-scheduling and multi-platform posting. Posts can be scheduled for optimal engagement times (based on AI analysis). The system automatically adapts the same content for multiple platforms with platform-specific tweaks. Moreover, the copilot performs engagement analysis and smart recommendations, monitoring likes, shares, and comments. It uses LLM-driven insights to suggest improvements:

* 1. "Your posts perform best on Thursdays at 6 PM."
  2. "Try adding a question to increase engagement!"
  3. "Hashtags #AI and #Tech are trending, consider adding them!"

It can also do LLM-Powered Audience Targeting & Hashtag Suggestions, identifying target audiences based on post content and suggesting relevant hashtags and tagging influencers for better reach. The copilot drafts quick replies to user comments and detects potential collaborations and suggests outreach messages.

An example flow in action can be as follows:

For user input *"I want to promote my new startup on social media"* social promotion copilot optimizes post Suggestions:

* 1. Twitter: *"Exciting news! 🚀 Our startup [Startup Name] is launching soon! Stay tuned for innovation in [industry]. #Startup #Innovation"*
  2. LinkedIn: *"We are thrilled to introduce [Startup Name], a game-changer in [industry]. Learn more about our journey here: [link]"*
  3. Instagram: *"A dream turning into reality! 🏆 Follow our startup journey. #Startuplife #NewBeginnings"*

It suggests best posting time "Your audience is most active between 5 PM and 11 OM. Schedule now?" and Hashtag & Tagging: "#Entrepreneurship #TechStartup #Innovation". Copilogt also recommends to "Consider tagging industry leaders like @TechInfluencer to boost visibility!". If someone comments *"Congrats!"*, Copilot suggests: *"Thank you! Exciting times ahead! 🚀"*

# Copilot Architecture

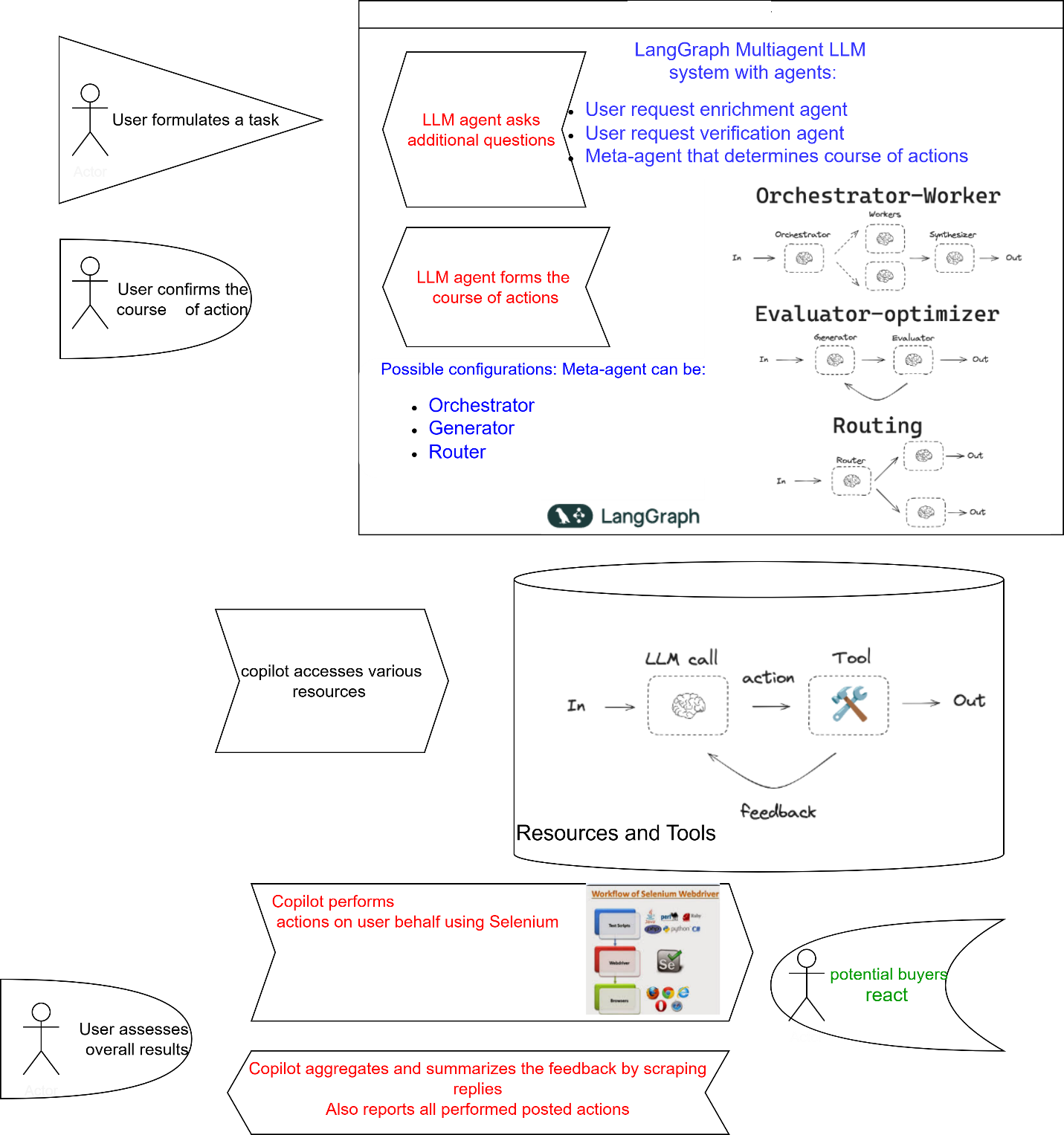


Fig …. LangGraph Supports Social Promotion Copilot Architecture

LangGraph is a multi-agent framework that enables structured interactions between AI agents, making it well-suited for building a Social Promotion Copilot. LangGraph enhances the copilot's capabilities in the following ways (Fig …):

1. User Interaction & Task Formulation. A user formulates a promotional task (e.g., “Promote my new product on social media”). LangGraph triggers a multi-agent process to refine the request.
2. Multi-Agent LLM Processing. LangGraph orchestrates different AI agents to process the request. User request enrichment agent analyzes the task and asks follow-up questions (e.g., "What platforms should be targeted?"). User request verification agent ensures clarity and coherence and verifies correctness before execution.
3. Copilot meta-agent (decision maker) determines the best promotional strategy and generates an optimized course of actions. The copilot accesses external resources (e.g., market data, previous campaigns, user preferences) and automates content creation based on the refined user request.
4. The copilot performs action execution and social media automation. It automatically performs actions (e.g., posting content, engaging with users, analyzing responses. Automation tools (e.g., Selenium, APIs) execute the generated promotional tasks.
5. LangGraph optimizes future actions using orchestrator-Worker Agents (for automation execution), evaluator-optimizer for engagement analytics and routing Agents (for personalized content delivery). Copilot also monitors how other users react to posts. It dynamically adjusts engagement strategies (e.g., replying to comments, boosting trending content). Feedback loops ensure continuous improvement.

Hence LangGraph provides a structured agent-based approach for building a Social Promotion Copilot, ensuring efficient task automation, decision-making, and engagement tracking. Its multi-agent design allows for scalability and adaptability, making it an ideal framework for AI-driven social media promotion.

LangGraph utilizes three primary architectural components — Orchestration-Worker, Evaluator-Optimizer, and Routing — to manage and improve complex processes like those involved in social promotion campaigns. Each component has a specific role in ensuring that the system functions efficiently, responds to real-time data, and adapts to user behaviors.

The Orchestration-Worker in LangGraph is the central hub that coordinates the execution of tasks across various agents and platforms. It ensures that the workflow is distributed efficiently and effectively, managing all aspects of content delivery, campaign scheduling, and real-time interactions. This component allows LangGraph to handle multiple processes concurrently.

The Evaluator-Optimizer in LangGraph monitors the performance of various campaigns and adjusts strategies dynamically to ensure that marketing efforts are continually improved. This component uses real-time data to assess the effectiveness of different promotional activities and modifies them to maximize impact. Router is a meta-agent maintaining state transitions.

**Selenium** is primarily used for web application testing and can be used across various browsers (e.g., Chrome, Firefox, Safari) and platforms**.** The core component allows interaction with web browsers through programming scripts. In this project we use Selenium to automate scraping and posting on behalf of a user.

## Other LLM + action engines integration

LaVague (2024) Introduce Web Agent framework for builders. Similar to the current work, it combines LLM and automation tool like Selenium

LaVague is an open-source framework designed for developers who want to create AI Web Agents to automate processes for their end users.

Our Web Agents can take an objective, such as "Print installation steps for Hugging Face's Diffusers library," and generate and perform the actions required to achieve the objective.

LaVague Agents are made up of:

1. A world Model that takes an objective and the current state (aka the current web page) and outputs an appropriate set of instructions.
2. An action engine which “compiles” these instructions into action code, e.g., Selenium or Playwright & executes them

# Use case: Complain copilot

The Complaint Copilot is an intelligent system designed to assist users in filing complaints efficiently. It helps by analyzing, reformulating, and enhancing complaints while also suggesting further actions and automating complaint submissions across multiple platforms, such as social media and consumer advocacy websites.

The user submits a raw complaint such as, "My internet provider has constant outages, and support is unhelpful". The system extracts key entities like company name, issue type, location, and service type. The system dynamically generates follow-up questions to gather more details:

* + "How long have you experienced these issues?"
  + "Have you contacted customer support? If yes, what was their response?"
  + "Do you have supporting evidence (screenshots, receipts, chat logs)?"

These questions ensure that the complaint is detailed enough to be effective.

Complaint copilot rewords the complaint into a more formal, persuasive, and legally sound version. It uses LLM-based sentiment analysis to enhance clarity and impact. An example reformulation is as :

* + Original: "My internet provider sucks. It's always down, and support ignores me."
  + Enhanced: "I have been experiencing frequent internet outages with [Provider Name] for the past [X] weeks. Despite multiple attempts to contact customer support, my issue remains unresolved. This has significantly impacted my work and daily life. I request immediate intervention and a resolution."

Based on the complaint type, the system suggests next actions, such as:

* + Filing a complaint with regulatory authorities (e.g., FCC, Ombudsman).
  + Contacting consumer protection organizations.
  + Seeking compensation (e.g., refund, discount, service credit).

The advice is customized using LLM-driven recommendations.

Complaint copilot performs auto-posting on social media and consumer advocacy platforms. The enhanced complaint is automatically formatted for posting on:

* + Twitter/X, Facebook, Instagram, Reddit – for public awareness.
  + Consumer advocacy sites (e.g., Trustpilot, BBB, Ripoff Report).
  + Company complaint portals (e.g., "Submit a complaint" pages).

Complaint copilot retrieves company-specific contact handles (e.g., @CompanySupport) and inserts them into posts for maximum visibility.

Complaint copilot leverages LLM-powered NLP – Text analysis, question generation, complaint enhancement, API Integrations that performs Social media posting (X/Twitter, Facebook API), consumer complaint portals, sentiment and intent Detection – to improve phrasing and impact. Moreover, complaint copilot uses Automation Scripts – Auto-filling complaint forms on advocacy websites.

Example Flow in Action:

User Input:

*"My flight was canceled last minute, and the airline refused a refund. What should I do?"*

Complaint Copilot Workflow:

1. Follow-up questions:
   * "Which airline was it?"
   * "Do you have proof of cancellation?"
   * "Did they offer an alternative flight?"
   * "Are you requesting a refund or compensation?"
2. Reformulated Complaint:
   * "I booked a flight with [Airline] on [Date], but it was canceled at the last minute. The airline has refused to issue a refund despite my request. According to aviation regulations, I am entitled to compensation. I seek immediate resolution and reimbursement."
3. Advice:
   * "File a complaint with the airline’s dispute resolution team."
   * "Report the issue to the Department of Transportation or Air Passenger Rights agency."
   * "If unresolved, escalate to a consumer protection body."
4. Automated Posting:
   * Twitter post: "@Airline, my flight was canceled, and I was denied a refund. As per regulations, I am entitled to compensation. Please resolve this immediately! #CustomerRights #FlightCancellation"
   * Complaint submitted on Trustpilot & BBB.



Fig…. A customer files a complaint via Complaint Copilot on the airline Facebook page



Fig …. Generic complaint agent Keving Glinka auto posts complaints using Complaint Copilot

A screenshot of a computer screen

AI-generated content may be incorrect.

Fig …. Compliant copilot architecture

The architecture of the Complaint Copilot based on Selenium consists of multiple components working together to automate the complaint submission process across various platforms. Through a user interaction layer, a user shares a complaint. An LLM processes the Complaint, reformulates the complaint and fills in missing details. Also, the LLM determines whether the complaint is valid or just an emotional reaction, asking additional questions to refine the complaint. The user confirms the course of action.

Complaint Copilot (Automation Layer) makes the discovery, identifying relevant sites where complaints can be filed. It also discovers users with complaints to promote the Complaint Copilot service. The Copilot accesses various complaint submission resources, including social Media (Facebook, LinkedIn, Twitter/X, Reddit, Instagram, TikTok ) and consumer protection sites: Better Business Bureau, official company support forums, etc.

Under automated complaint filing using Selenium, the Copilot requests the LLM to generate Selenium scripts for automated complaint submission on different platforms. Selenium executes the generated scripts, automating complaint postings across multiple resources. The engagement is continuous: the Copilot monitors responses and continues communication on behalf of the user. It tracks reactions from companies and updates users.

The Copilot uses Selenium for web automation, including automating form submissions, navigating different platforms and handling authentication if necessary. Hence the Selenium engine supports complaint submission, review, and tracking.

Companies may react to complaints submitted by the Copilot. The system tracks responses and informs the user of updates. If needed, the Copilot can generate follow-up responses.

This architecture leverages LLMs for complaint refinement and decision-making, while Selenium handles automation of complaint submission across multiple platforms. The combination allows for an efficient and scalable way to manage consumer complaints, ensuring that they are effectively submitted and followed up.

# Run-time execution of a textual task

The user inputs a task description (e.g., "Generate a function that calculates Fibonacci numbers").

The script queries an LLM to generate Python code.

It prints the generated code.

It executes the generated code using exec().

def generate\_code(task\_description):

"""

Uses an LLM to generate Python code based on a textual task description.

"""

prompt = f"Write a Python script that accomplishes the following task:\n{task\_description}\n\nOnly provide the code without explanations."

response = openai.ChatCompletion.create(

model="gpt-4", # Use GPT-4 or another available model

messages=[{"role": "user", "content": prompt}],

temperature=0.2

)

code = response["choices"][0]["message"]["content"]

return code

def execute\_code(code):

"""

Executes the generated Python code safely.

"""

try:

exec\_globals = {}

exec(code, exec\_globals)

except Exception as e:

print("Error executing code:", e)

if \_\_name\_\_ == "\_\_main\_\_":

task\_description = input("Describe the coding task: ")

generated\_code = generate\_code(task\_description)

print("\nGenerated Code:\n", generated\_code)

print("\nExecuting Code...\n")

execute\_code(generated\_code)

The steps are as follows:

1. Copilot inputs a task description (e.g., "Generate Selenium code to do authentication and submit a complaint via form").
2. The script queries an LLM to generate Python code.
3. It executes the generated code using exec().

# Marketing strategies

**Extending Promotional Strategies with a Social Promotion Copilot**

Many marketing efforts focus on promotional activities that support the launch of new products, playing a crucial role in the early stages of the product life cycle. The success of these promotions significantly influences the diffusion and adoption of new products in competitive markets (Delre et al 2007). With the rise of artificial intelligence and automation, social promotion copilots — AI-driven assistants designed to optimize and execute promotional strategies across digital platforms—offer a transformative approach to enhancing product visibility and consumer engagement.

This paper extends traditional promotional strategy models by integrating an agent-based simulation of a Social Promotion Copilot that automates and personalizes social media interactions, content distribution, and influencer engagement to optimize product launches. The model investigates the efficacy of SPC-driven promotional strategies by focusing on three key aspects: targeting, timing, and adaptive engagement.

Simulation experiments indicate that AI-assisted promotional activities significantly impact diffusion dynamics, amplifying both reach and engagement. The findings highlight that:

1. The absence of promotional support and/or improper timing can lead to product diffusion failure. AI-powered copilots can mitigate this risk by dynamically adjusting promotion schedules based on real-time consumer sentiment, trends, and engagement metrics.
2. The optimal targeting strategy involves addressing distant, small, and cohesive consumer groups. The copilot leverage machine learning to identify micro-communities within social networks, tailoring messages to resonate with their specific interests and behaviors.
3. The optimal timing for promotions varies by product category, particularly between durable goods (e.g., home appliances) and consumer electronics. AI-enhanced strategies can refine timing by analyzing historical data, seasonality trends, and consumer readiness indicators.

Beyond these findings, the integration of the Copilot introduces continuous learning and adaptive engagement, allowing brands to refine their promotional strategies dynamically. By utilizing natural language processing, sentiment analysis, and reinforcement learning, the Copilot can craft personalized responses, automate influencer collaborations, and enhance social proof mechanisms—further accelerating product diffusion.

This research contributes to the planning and management of AI-enhanced promotional strategies, demonstrating how Copilots can revolutionize product launch campaigns by maximizing efficiency, engagement, and long-term adoption rates.

## Diffusion of new products

SPC can play a crucial role in supporting and accelerating product diffusion throughout the entire S-shaped adoption curve (Fig …) by leveraging AI-driven strategies that optimize both external and internal influences on consumer behavior.

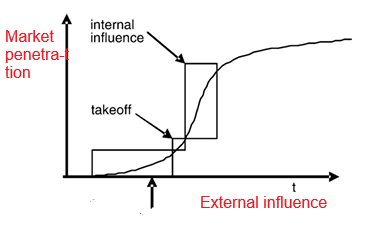


Fig … . The S-shaped curve of the diffusion

In the early phase, when sales are slow and external influences dominate, SPC can enhance traditional promotional activities by identifying and targeting early adopters more effectively. Using advanced predictive analytics and sentiment analysis, SPC can pinpoint potential buyers based on online behavior, interests, and engagement history. It can also automate personalized outreach, manage influencer collaborations, and optimize ad placements across social media platforms to ensure the right audience is exposed to the product at the right moment.

As the product gains traction and reaches the critical mass needed for takeoff, SPC can facilitate the transition from mass promotions to more organic, community-driven engagement. By continuously analyzing consumer interactions, it can refine messaging to amplify word-of-mouth marketing and social contagion effects. SPC can also monitor customer feedback in real-time, enabling businesses to quickly adjust strategies, resolve concerns, and boost positive sentiment, which further accelerates adoption.

In the mature phase, where internal influences become dominant, SPC can sustain engagement by curating user-generated content, encouraging reviews and testimonials, and maintaining brand presence through personalized interactions. By automating customer follow-ups and loyalty campaigns, it helps maximize long-term retention while identifying opportunities for cross-selling and up-selling.

Ultimately, the Copilot enhances the efficiency of each phase of product diffusion by ensuring seamless coordination between promotional efforts, customer engagement, and organic adoption trends. This AI-driven approach minimizes wasted marketing spend, shortens the time to critical mass, and maximizes the overall impact of a product launch.

Business-to-Consumer and Business-to-Business settings of SPC

SPC operates differently in Business-to-Consumer (B2C) and Business-to-Business (B2B) settings, adapting its strategies to suit the distinct characteristics of each market.

In a B2C environment, SPC focuses on high-volume, emotion-driven, and fast-paced interactions with individual consumers. The copilot uses AI-powered personalization, real-time engagement, and automation to maximize outreach and drive conversions.

* Personalized Marketing at Scale: SPC analyzes consumer data, behaviors, and preferences to deliver highly targeted ads, product recommendations, and promotional messages. For example, it can send personalized discounts to consumers who have shown interest in a product but haven’t made a purchase.
* Social Media Engagement: SPC automates interactions on platforms like Instagram, TikTok, and Facebook by commenting, liking, and engaging with potential customers, fostering brand visibility. It also monitors trends and viral content to adjust marketing strategies dynamically.
* Influencer and WOM Amplification: SPC identifies key influencers and brand advocates to encourage product endorsements and reviews, amplifying word-of-mouth marketing.
* Automated Customer Support & Retention: Through AI-powered chatbots and automated messaging, SPC answers FAQs, processes orders, and provides personalized follow-ups, increasing brand loyalty and repeat purchases.

In B2B markets, where sales cycles are longer and decision-making involves multiple stakeholders, SPC acts as a relationship-building and lead-nurturing assistant. Instead of mass outreach, it focuses on high-value engagement, trust-building, and decision support.

* AI-Driven Lead Qualification: SPC analyzes potential leads’ online behavior, company size, and engagement with marketing materials to prioritize high-quality prospects, ensuring sales teams focus on the most promising opportunities.
* Automated Outreach & Content Personalization: SPC crafts personalized email sequences, LinkedIn messages, and follow-ups tailored to different stakeholders in the decision-making process, ensuring continued engagement.
* Thought Leadership & Brand Positioning: SPC automates content distribution by posting whitepapers, case studies, and industry insights on LinkedIn, Twitter, and professional forums, establishing the company as an authority in its field.
* CRM Integration & Sales Support: By integrating with Customer Relationship Management (CRM) systems, SPC ensures seamless tracking of interactions, sends reminders for follow-ups, and provides insights into when and how to engage with leads.
* Event and Webinar Engagement: SPC can automate invitations, reminders, and post-event follow-ups, ensuring that businesses maximize attendance and engagement in virtual or physical networking events.

Key Differences in SPC’s Role for B2C vs. B2B are shown in Table …

Table … Comparative features of B2C and B2B

| Feature | B2C Approach | B2B Approach |
| --- | --- | --- |
| Sales Cycle | Short, impulse-driven | Long, relationship-driven |
| Engagement Style | High-volume, social media-centric | Targeted, professional networking-focused |
| Content Type | Short-form ads, viral content | Whitepapers, case studies, webinars |
| Customer Relationship | One-time purchases & repeat buyers | Long-term partnerships & high-value deals |
| Decision-Making | Individual-driven, emotional | Group-driven, logical |

Hence the Copilot adapts to the unique dynamics of B2C and B2B markets by optimizing engagement strategies for each setting. In B2C, it focuses on personalization, automation, and viral reach to drive consumer purchases. In B2B, it prioritizes lead nurturing, trust-building, and long-term relationship management. By leveraging AI, SPC ensures that businesses, regardless of their market type, achieve more efficient, data-driven, and impactful promotional efforts.

# Evaluation

Evaluating a **Social Promotion Copilot** requires assessing multiple aspects of its performance, from user engagement to the effectiveness of the promotional strategies. Here are some key metrics and methods for evaluating an SPC:

**1. Engagement Metrics**

* **User Interaction Rate**: Measure how frequently users interact with posts promoted or managed by the SPC. This includes likes, shares, comments, and replies.
* **Click-Through Rate (CTR)**: Evaluate how many users click on links or content shared by the SPC in comparison to the total number of views or impressions.
* **Sentiment Analysis**: Use natural language processing tools to analyze the sentiment of comments or interactions, determining whether the SPC is fostering positive or negative sentiment around the brand.

**2. Conversion Metrics**

* **Conversion Rate**: Evaluate how effective the SPC is at driving users to take a desired action (e.g., purchasing a product, signing up for a newsletter, etc.).
* **Lead Generation**: Track how many leads are generated through the promotions managed by the SPC, and whether these leads translate into sales or conversions.
* **Sales Uplift**: Measure whether the promotions managed by the SPC result in an increase in product sales, compared to periods when promotions were managed manually or with traditional methods.

**3. Reach and Impressions**

* **Impressions and Reach**: Evaluate how many people have been exposed to the promotions or content managed by the SPC. This can help measure brand awareness.
* **Audience Growth**: Measure how the social media follower base grows over time with the SPC's involvement. This includes tracking new followers, especially from niche target audiences.
* **Frequency of Interaction**: Track how often the SPC posts, comments, or engages with users on various platforms to ensure a healthy and consistent interaction rate.

**4. Content Performance**

* **Content Quality**: Evaluate the relevance and engagement of the content shared by the SPC. This can include looking at how well the content resonates with the target audience (e.g., does it align with audience interests, trends, and feedback?).
* **Personalization Success**: Measure how effectively the SPC personalizes promotions based on user data (e.g., location, preferences, behavior).
* **A/B Testing**: Run experiments where the SPC promotes two versions of content or campaigns and measure which version performs better in terms of engagement, conversions, etc.

**6. Customer Satisfaction and Feedback**

* **User Feedback**: Collect feedback from users interacting with the SPC. Surveys or direct feedback can be used to assess their satisfaction with the automated interactions and the effectiveness of the promotions.
* **Trust and Transparency**: Evaluate how users perceive the authenticity and reliability of the SPC. Some users might be skeptical of automated interactions, so measuring trust is essential in ensuring that the SPC maintains positive relationships with the audience.

**7. Comparison with Manual Promotion**

* **Benchmarking**: Compare the results from SPC-driven promotions with those manually handled by a marketing team. This comparison should evaluate the effectiveness, speed, and overall results in terms of engagement, conversion, and ROI.
* **Experimentation**: Run parallel tests where one group of users receives promotions via SPC, while another group is exposed to traditional methods. This can provide clear insights into how much more effective the SPC is at driving desired outcomes.

**8. Behavioral Analytics**

* **User Segmentation**: Analyze how well the SPC identifies and targets different user segments. For instance, how effectively does it engage various demographics, geographies, or behavioral groups?
* **Path to Conversion**: Measure how users interact with SPC-promoted content and whether their behavior aligns with a typical customer journey that leads to conversion (e.g., awareness > interest > action).

**9. Social Listening and Brand Sentiment**

* **Social Media Listening Tools**: Use tools like Brandwatch or Hootsuite to track mentions of the brand, product, or campaign promoted by the SPC. Analyze whether the brand is being discussed positively or negatively and how the SPC influences these discussions.
* **Trend Monitoring**: Track whether the SPC helps in setting or maintaining trends related to the brand or product.

# Related Work

Galitsky et al 2014 introduced a simulated human-like agent designed to act on behalf of its human host, facilitating and managing online communication. This agent alleviates its host from routine and less critical social networking activities, such as sharing news, commenting on messages, blogs, forums, images, and videos. Unlike many applications of simulated human characters, the agent’s social interactions occur without necessarily revealing its automated nature to conversation partners. It engages in the exchange of news, opinions, and updates as if it were the human host. This system was names Conversational Agent for Social Promotion (CASP). To evaluate CASP’s effectiveness and trustworthiness, we conducted experiments across multiple Facebook accounts, analyzing its performance in fostering engagement and facilitating seamless human-like interactions.

Communicating with Friends on Behalf of a Human Host

In today’s digital era, social media platforms like Facebook, LinkedIn, Instagram, and X have expanded users' networks far beyond close friends and family. On average, individuals maintain connections with hundreds or even thousands of contacts across these platforms. However, despite the vastness of these networks, active engagement remains limited to a small circle—typically 10-20 close friends, family members, and colleagues. The majority of connections receive little to no interaction, leading to the perception that these relationships have been neglected or abandoned.

Yet, maintaining a broader and more active social presence is increasingly valuable for both personal and professional growth. Whether for career networking, personal branding, or community engagement, users are expected to demonstrate interest in their connections by responding to posts, acknowledging life events, and actively participating in discussions. However, the sheer volume of interactions required to sustain these relationships demands significant time and effort—something many users struggle to manage.

To bridge this gap, intelligent automation, such as **CASP,** can assist users by handling routine social interactions. While users continue to engage personally with close friends and family, CASP can maintain communication with wider networks by liking, sharing, and commenting on posts in a meaningful and contextually appropriate manner. By automating aspects of social interaction, CASP helps users sustain a consistent and engaged online presence without the overwhelming time commitment, ensuring that professional and social relationships remain active and beneficial.

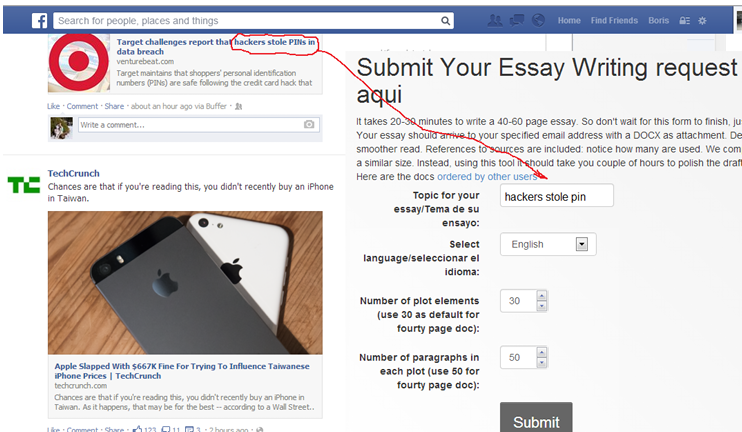


Fig … Interactive mode of CASP: a user can write an essay concerning an opinion of her peer.

To enhance the legacy CASP system, modern LLMs and related AI technologies significantly improve its capabilities in personalization, contextual understanding, and automation. Here are some key technologies that would enhance CASP today:

1. Transformer-Based LLMs (e.g., GPT-4, Claude, Gemini, Mistral) improve context awareness, processing long conversations, understanding nuances in social interactions, and generating contextually appropriate responses. These LLMs can adapt to a user’s communication style by learning from past interactions (Galitsky 2025).
2. Use of Retrieval-Augmented Generation (RAG) would enhanced relevance: by integrating real-time information retrieval, CASP can generate responses based on recent news, trends, or user-specific data. Also, leveraging personalized knowledge base, CASP would be able to maintain a dynamic memory of a user’s preferences, conversation history, and past engagements.
3. Reinforcement Learning from Human Feedback would assure better engagement optimization: CASP can be trained with human feedback to ensure responses align with user intent, avoiding robotic or inappropriate messaging. It would also assure ethical and safe communication, preventing generating controversial or insensitive responses that could harm relationships (Bai et al 2022).
4. Fine-Tuned Social AI Models (e.g., Llama 3, Mixtral) provide context-specific adaptation (Bakker et al 2022, Yin et al 2024). By fine-tuning models on social media data, CASP can generate responses that align with social norms and platform-specific etiquette. The emotional intelligence is essential as well: CASP can be trained to detect emotional tones in posts and respond empathetically.
5. Role-specific agents can be a foundation of different AI modules that handle various aspects of social promotion—one for casual interactions (Fig …), another for professional networking, and one for content recommendation. Using AI planning models (like AutoGPT or BabyAGI), CASP can decide when to engage and when to remain passive.

Future Potential Enhancements include LLM-powered auto-generated posts & replies: CASP could draft meaningful social media posts based on a user’s interests, past interactions, and trending topics. Emotion and sentiment-based responses can be achieved based on the sentiment detected in messages, ensuring a more natural and engaging interaction. As virtual spaces grow, CASP could extend to managing interactions in 3D social environments. By leveraging these advancements, CASP can evolve into an intelligent social assistant that maintains a user’s digital presence seamlessly while ensuring meaningful and context-aware interactions.



Fig … CASP is posting a message related to friend’s travel

## Empowering Social Media Engagement

Teens and content creators often struggle to effectively promote positive messages and engage meaningfully on social media. One promising approach is to empower users with AI-driven assistance to enhance engagement strategies and cultivate supportive online communities. While numerous social media automation tools exist, little research has explored designing chatbots that provide contextualized, real-time guidance for improving online interactions.

This study involved social media users and digital marketers in two design sessions: (1) an in-depth interview to identify challenges in effective promotion and audience engagement, and (2) interaction with the "Social Promotion Copilot" chatbot prototype to develop design guidelines for overcoming these challenges. Qualitative analysis of these interactions revealed three primary barriers to successful social media promotion:  
a) Lack of strategic knowledge about platform algorithms, audience preferences, and engagement techniques.  
b) Emotional barriers, such as fear of negative feedback, imposter syndrome, or uncertainty in messaging.  
c) Limited understanding of audience dynamics, leading to ineffective or misaligned messaging.

Key parameters were identified to optimize chatbot responses and support effective promotion, including:  
a) Adopting multiple personas to simulate diverse audience perspectives.  
b) Using an engaging, friendly, and supportive tone to encourage confidence.  
c) Providing clear, specific, and adaptable suggestions for different platforms and audiences.  
d) Optimizing message length and format for each platform’s best practices.

These insights inform the design of personalized and scalable AI-driven tools that empower users to enhance social media engagement, foster positive interactions, and amplify meaningful content effectively.

Brik et al (2024) illustrate the merits, potentials, and limitations of using ChatGPT as a co-pilot to assist faculty in refining the assessment design process. This research brings into evidence the importance of keeping a ‘human in the loop’ perspective during the faculty-ChatGPT assessment co-creation activities

## Retail copilot

Building a successful AI copilot involves a comprehensive and systematic approach, ensuring both technical excellence and alignment with user needs.. To illustrate the practical application of these concepts, (Furmakiewicz et al 2024) uses a case study of Microsoft’s development of copilot templates within the retail domain, highlighting the significance of each design component. Additionally to LLM, the authors examine the role of plugins, which enable the copilot to retrieve knowledge and execute actions, enhancing its functionality. Orchestration, which ensures seamless coordination between components, is also discussed, along with system prompts that guide the copilot’s behavior. Furthermore, responsible AI guardrails are explored, emphasizing the importance of fairness, transparency, and safety in AI systems.

Testing and evaluation are the keys to ensuring the AI copilot meets its objectives and avoids unintended negative outcomes in real-world applications. This includes the use of an end-to-end human-AI decision loop framework, which offers a structured approach for assessing how the copilot interacts with users and impacts business processes. Furmakiewicz et al 2024 discuss methods for measuring and improving both the quality and safety of the copilot, ensuring it is reliable, effective, and aligned with ethical standards.

By providing a detailed examination of both the design and evaluation stages, this paper offers concrete insights into the anatomy of an AI copilot. It underscores the importance of thoughtful design practices and robust testing methodologies in building AI assistants that are not only technologically advanced but also human-centered, ethical, and capable of driving positive outcomes in business contexts.

## Github copilot

GitHub Copilot is an AI-powered code completion tool developed by GitHub in collaboration with OpenAI. It acts as an intelligent assistant that helps software developers write code faster and more efficiently by suggesting relevant code snippets, functions, and even entire lines of code based on the context of the project. Built on OpenAI's Codex model, GitHub Copilot is trained on a vast array of publicly available programming resources, including open-source projects, which enables it to provide relevant, context-aware suggestions across various programming languages. This makes Copilot a powerful tool for both experienced developers and beginners, offering real-time coding assistance and reducing the need to search for solutions or consult documentation.

One of GitHub Copilot’s most notable features is its ability to generate code based on simple comments or descriptions written by the developer. For instance, by typing a comment outlining the desired functionality of a specific function, Copilot can generate a functional implementation in the chosen programming language. This makes it especially valuable for streamlining the development process, as it reduces the time spent on routine coding tasks. Additionally, Copilot supports multiple languages and frameworks, making it versatile for a wide range of development projects, from web development to machine learning.

Despite its potential, GitHub Copilot also raises important questions about intellectual property, ethics, and dependency on AI in software development. Since Copilot is trained on publicly available code, concerns have emerged about the tool inadvertently suggesting copyrighted or non-original code without proper attribution. GitHub has introduced some guardrails to address these concerns, such as disclaimers about code reuse and safeguards to prevent inappropriate suggestions. Furthermore, while Copilot helps accelerate development, it is important for developers to maintain a critical eye and not rely solely on AI-generated code without verifying its accuracy and suitability for the intended project. As AI tools like GitHub Copilot continue to evolve, their role in software development will likely grow, prompting ongoing discussions about best practices and responsible usage.

## Uncanny Valley and **Social Actors** paradigms

The **Uncanny Valley** hypothesis (**Mori** et al 2012) suggests that as a robot or virtual agent becomes more human-like, people tend to feel increasingly comfortable with it—until a certain threshold is reached. At this point, slight imperfections in realism create an eerie, unsettling feeling, leading to **negative emotional reactions**. This dip in emotional response is referred to as the "Uncanny Valley." However, as realism continues to improve beyond this valley, human acceptance increases again. Human-like virtual influencers may fall into the Uncanny Valley if their appearance and behavior are **almost, but not quite, human**, leading to lower engagement and discomfort among users. For **example,** a cartoonish robot may feel friendly and non-threatening, but a highly realistic android with unnatural facial expressions or slightly stiff movements can feel unsettling.

The **Computers Are Social Actors** paradigm (Reeves and Nass 1996), suggests that humans naturally apply social rules and expectations to computers, AI, and virtual agents, **even when they know they are interacting with a machine**. People subconsciously treat digital entities as if they have personalities, emotions, and social roles, responding with politeness, social norms, and biases similar to those in human-to-human interactions. If users unconsciously treat virtual influencers as social beings, their expectations for natural behavior and emotional authenticity may shape their reactions. This could lead to differences in engagement and trust between **human-like** and **non-human-like** virtual agents. Users might say "thank you" to a virtual assistant like Siri or Alexa, or feel frustrated when a chatbot provides an unhelpful response.

# Conclusions

**Complaint copilot:**

✔ **Saves Time** – Automates the tedious process of crafting and submitting complaints.  
✔ **Enhances Impact** – Ensures complaints are well-written and legally sound.  
✔ **Improves Success Rate** – Directs users to the best escalation paths.  
✔ **Public Pressure** – Leverages social media for faster company responses.

As virtual agents become increasingly common across various domains, virtual influencers have emerged on social media platforms, engaging with users and integrating into human networks.

Drawing on research in human-computer interaction, the Uncanny Valley hypothesis, and the Computers Are Social Actors paradigm, Arsenyan and Mirowska (2021) examines:

1) how virtual agents exhibit human-like behavior within social networks, and

2) how users react to human versus virtual agents in publicly visible interactions. Analyzing text and emoji responses to posts made by a human influencer, a human-like virtual influencer, and an anime-style virtual influencer over an 11-month period, we found that the human-like virtual influencer received significantly fewer positive reactions. This supports the Uncanny Valley hypothesis, as additional measures of negative reactions followed a similar trend, despite the generally positive nature of the platform.

# References

LaVague (2024) **LaVague: Web Agent framework for builders.** <https://github.com/lavague-ai/LaVague>

**Golder PN , G.J. Tellis. Growing, growing, gone: cascades, diffusion, and turning points in the product life cycle. Marketing Sci, 23 (2) (2004), pp. 207-218**

**Mahajan V, E. Muller. Innovation diffusion and new product growth models in marketing**

**Journal of Marketing, 43 (1979), pp. 55-68**

**Arsenyan J, Agata Mirowska (2021) Almost human? A comparative case study on the social media presence of virtual influencers, International Journal of Human-Computer Studies,**

**Volume 155, 2021**

**Mori, M., MacDorman, K. F., & Kageki, N. (2012). *The Uncanny Valley [From the Field]*. IEEE Robotics & Automation Magazine, 19(2), 98–100.**

Zou W, Qian Yang, Dominic DiFranzo, Melissa Chen, Winice Hui, Natalie N. Bazarova (2024)

Social Media Co-pilot: Designing a chatbot with teens and educators to combat cyberbullying,

International Journal of Child-Computer Interaction, V 41

Reeves, B., & Nass, C. (1996). *The Media Equation: How People Treat Computers, Television, and New Media Like Real People and Places*. **Cambridge University Press.**

Eager,B., & Brunton, R. (2023). Prompting higher education towards AI-augmented teaching and learning practice. Journal of University Teaching & Learning Practice, 20(5). <https://doi.org/10.53761/1.20.5.02>

Su, J., & Yang, W. (2023). Unlocking the power of ChatGPT: A framework for applying Generative AI in education. ECNU Review of Education, 6(3), 355-366. <https://doi.org/10.1177/20965311231168423>

Xu C (2024) Integrating AI Tools into Teaching Practice: Unleash the Potential of Your AI Co-pilot. The Future of Education 14th Edition 2024

PRNewswire (2023) Baidu Unveils ERNIE Bot, the Latest Generative AI Mastering Chinese Language and Multi-Modal Generation. <https://www.prnewswire.com/news-releases/baidu-unveils-ernie-bot-the-latest-generative-ai-mastering-chinese-language-and-multi-modal-generation-301774240.html>

Furmakiewicz M, Chang Liu, Angus Taylor, Ilya Venger (2024) Design and evaluation of AI copilots -- case studies of retail copilot templates. Design and evaluation of AI copilots -- case studies of retail copilot templates. arXiv:2407.09512

Chiam J, Aloysius Lim, Cheryl Nott, Nicholas Mark, Ankur Teredesai, Sunil Shinde (2024) Co-Pilot for Health: Personalized Algorithmic AI Nudging to Improve Health Outcomes. arXiv:2401.10816

Bakker M, Martin Chadwick, Hannah Sheahan, Michael Tessler, Lucy Campbell-Gillingham, Jan Balaguer, Nat McAleese, Amelia Glaese, John Aslanides, Matt Botvinick, Christopher Summerfield. (2022) Fine-tuning language models to find agreement among humans with diverse preferences. Advances in Neural Information Processing Systems 35 (NeurIPS 2022)

Kai Yin K, Chengkai Liu, Ali Mostafavi, Xia Hu (2024) CrisisSense-LLM: Instruction Fine-Tuned Large Language Model for Multi-label Social Media Text Classification in Disaster Informatics arXiv:2406.15477

Yuntao Bai Y, Andy Jones, Kamal Ndousse, Amanda Askell, Anna Chen, Nova DasSarma, Dawn Drain, Stanislav Fort, Deep Ganguli, Tom Henighan, Nicholas Joseph, Saurav Kadavath, Jackson Kernion, Tom Conerly, Sheer El-Showk, Nelson Elhage, Zac Hatfield-Dodds, Danny Hernandez, Tristan Hume, Scott Johnston, Shauna Kravec, Liane Lovitt, Neel Nanda, Catherine Olsson, Dario Amodei, Tom Brown, Jack Clark, Sam McCandlish, Chris Olah, Ben Mann, Jared Kaplan (2022) Training a Helpful and Harmless Assistant with Reinforcement Learning from Human Feedback. arXiv:2204.05862

Delre SA, W. Jager, T.H.A. Bijmolt, M.A. Janssen (2007) Targeting and timing promotional activities: An agent-based model for the takeoff of new products. Journal of Business Research, V 60, Issue 8, 2007, pp 826-835,

Galitsky B (2019) A social promotion chatbot. In Developing Enterprise Chatbots. Springer Cham

[Galitsky](https://scholar.google.com/citations?user=kR_M3HIAAAAJ&hl=en&oi=sra) B, [D Ilvovsky](https://scholar.google.com/citations?user=n7VSUf8AAAAJ&hl=en&oi=sra), N Lebedeva, Usikov D (2014) Improving trust in automation of social promotion. AAAI Spring Symposium Series, Stanford CA 28-35.

Galitsky B (2021) Artificial Intelligence for Customer Relationship Management: Solving Customer Problems. Springer Cham

Galitsky B (2025) LLM- based Personalized Recommendations in Health. In Health Applications of Neuro-symbolic AI. Elsevier.

Top of Form