Transforming Competition into Collaboration: The Revolutionary Role of Multi-Agent AI Systems and Language Models in Modern Organizations

Carlos Cruz
carlos.cruz@fgv.edu.br
carlos.jose.x.cruz@gmail.com

Abstract

This article explores the dynamic influence of computational entities based on multi-agent systems theory (SMA) combined with large language models (LLM), which are characterized by their ability to simulate complex human interactions, as a possibility to revolutionize the potential of human interaction. -machine based on the use of specialized virtual agents to support everything from operational organizational processes to strategic decision-making based on applied knowledge and human orchestration. Previous investigations reveal that there are limitations, particularly in the autonomous approach of virtual agents, especially when dealing with new challenges and pragmatic tasks such as inducing logical reasoning and problem solving. It is also considered that traditional techniques, such as the stimulation of chains of thoughts, require explicit human guidance. In our approach we employ agents developed from large language models (LLM), each with distinct prototyping that considers behavioral elements, driven by strategies that stimulate the generation of knowledge based on the use case proposed in the scenario (role-play). business, using a discussion approach between agents (guided conversation). Our approach demonstrates the potential for developing metahumans useful in organizational strategies, based on multi-agent system theories (SMA) and innovative uses based on large language models (LLM based), offering a differentiated and adaptable experiment to diverse organizational challenges in an environment controlled cybernetic.

Keywords: Multi-Agent Systems (SMA), Artificial Intelligence (AI), Large Language Models (LLM), Virtual Agents

References

Brown, T. B., Mann, B., Ryder, N., Subbiah, M., Kaplan, J., Dhariwal, P., Neelakantan, A., Shyam, P., Sastry, G., Askell, A., Agarwal, S., Herbert-Voss, A., Krueger, G., Henighan, T., Child, R., Ramesh, A., Ziegler, D. M., Wu, J., Winter, C., … Amodei, D. (2020). *Language Models are Few-Shot Learners*. http://arxiv.org/abs/2005.14165

Chen, M., Tworek, J., Jun, H., Yuan, Q., Pinto, H. P. de O., Kaplan, J., Edwards, H., Burda, Y., Joseph, N., Brockman, G., Ray, A., Puri, R., Krueger, G., Petrov, M., Khlaaf, H., Sastry, G., Mishkin, P., Chan, B., Gray, S., … Zaremba, W. (2021). *Evaluating Large Language Models Trained on Code*. http://arxiv.org/abs/2107.03374

Cheng, Y., Zhang, C., Zhang, Z., Meng, X., Hong, S., Li, W., Wang, Z., Wang, Z., Yin, F., Zhao, J., & He, † Xiuqiang. (2024). *EXPLORING LARGE LANGUAGE MODEL BASED INTELLIGENT AGENTS: DEFINITIONS, METHODS, AND PROSPECTS*.

Cooper, A., Reimann, R., Cronin, D., & Noessel, C. (2014). *About Face: The Essentials of Interaction Design* (4th ed.). Wiley Publishing.

Davenport, T. H.; H. J. (2007). *Competing on Analytics: The New Science of Winning* (1st ed.). Harvard Business Review Press.

Devlin, J., Chang, M.-W., Lee, K., Google, K. T., & Language, A. I. (2019). *BERT: Pre-training of Deep Bidirectional Transformers for Language Understanding*. https://github.com/tensorflow/tensor2tensor

Fama, E. F. (1970). Efficient Capital Markets: A Review of Theory and Empirical Work. *The Journal of Finance*, *25*(2), 383. https://doi.org/10.2307/2325486

Huang, M.-H., & Rust, R. T. (2018). Artificial Intelligence in Service. *Journal of Service Research*, *21*(2), 155–172. https://doi.org/10.1177/1094670517752459

J. Pruitt, & T. Adlin. (2006). *The Persona Lifecycle*. Elsevier. https://doi.org/10.1016/B978-0-12-566251-2.X5000-X

Jung, C. G. (2014a). The Archetypes and the Collective Unconscious. In *Collected Works of C.G. Jung, Volume 9 (Part 1): Archetypes and the Collective Unconscious*. Routledge. https://doi.org/10.4324/9781315725642

Jung, C. G. (2014b). *Two Essays on Analytical Psychology*. Routledge. https://doi.org/10.4324/9781315725895

Kimball, R., & Ross, M. (2015). *The Kimball Group Reader*. Wiley. https://doi.org/10.1002/9781119228912

Langton, N., R. S. P. , & J. T. A. (2019). *Organizational behaviour: Concepts, controversies, applications* (Pearson Canada Inc, Ed.; 8th ed.).

Malone, T. W., & B. M. S. (2022). *Handbook of Collective Intelligence* (MIT, Ed.). MIT Press.

Maness, J. M., Miaskiewicz, T., & Sumner, T. (2008). Using Personas to Understand the Needs and Goals of Institutional Repositories. *D-Lib Magazine*, *14*(9/10). https://doi.org/10.1045/september2008-maness

Miaskiewicz, T., Sumner, T., & Kozar, K. A. (2008). A latent semantic analysis methodology for the identification and creation of personas. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, 1501–1510. https://doi.org/10.1145/1357054.1357290

Norman, D. A. (2002). *The design of everyday things*. Basic Books. http://www.amazon.de/The-Design-Everyday-Things-Norman/dp/0465067107/ref=wl_it_dp_o_pC_S_nC?ie=UTF8&colid=151193SNGKJT9&coliid=I262V9ZRW8HR2C

Rasal, S., & Hauer, E. J. (2024). *NAVIGATING COMPLEXITY: ORCHESTRATED PROBLEM SOLVING WITH MULTI-AGENT LLMS*.

Reed, S., Zolna, K., Parisotto, E., Colmenarejo, S. G., Novikov, A., Barth-Maron, G., Gimenez, M., Sulsky, Y., Kay, J., Springenberg, J. T., Eccles, T., Bruce, J., Razavi, A., Edwards, A., Heess, N., Chen, Y., Hadsell, R., Vinyals, O., Bordbar, M., & de Freitas, N. (2022). *A Generalist Agent*. http://arxiv.org/abs/2205.06175

Revella, A. (2015). *Buyer Personas: How to Gain Insight into your Customer's Expectations, align your Marketing Strategies, and Win More Business*. Wylei.

Russel, S., & Norvig Peter. (2022). *Artificial Intelligence: Vol. Fourth Edition*.

Saunders, A. C. M. (2018). *Financial Institutions Management A Risk Management Approach* (Ninth Edition).

Schick, T., & Schütze, H. (n.d.). *Few-Shot Text Generation with Natural Language Instructions*.

Timm, I. J., Davidsson, P., & Kirn, S. (2003). *Agent Technologies in Logistics*. https://www.researchgate.net/publication/2844339

Wooldridge, M. (2009). *An Introduction to MultiAgent Systems* (2nd ed.). John Wiley & Sons.

Wu, S., Irsoy, O., Lu, S., Dabravolski, V., Dredze, M., Gehrmann, S., Kambadur, P., Rosenberg, D., & Mann, G. (2023). *BloombergGPT: A Large Language Model for Finance*.

Yang, H., Liu, X.-Y., & Wang, C. D. (2023). *FinGPT: Open-Source Financial Large Language Models*. http://arxiv.org/abs/2306.06031