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Submitter Information

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General Comment

1. Background - Smarter Software not a bigger hardware/data Mousetrap: LLMs and Generative AI models enable insights to be gleaned from unstructured data like texts, images, videos however they are not by themselves 'intelligent' but merely a better way to store and retrieve knowledge which is a necessary component of intelligence but not sufficient. Machine learning models in general use massive amounts of computing power and energy to essential glean statistical patterns in lots of data. For other than the most routine of tasks, they don't work well in the real physical world of dynamic change, complex multidimensional problems and handling uncertainty. RAG and human feedback are essential to improve accuracy and relevance for other than the most routine and non-critical tasks (e.g. creative, media) or where a 'good first draft' is useful. Current ML solutions cannot explain their outputs; they have no introspection - they don't know whether they are right or wrong; and their memory is poor and ad hoc - failing to recollect what worked well in a specific situation and using these cases again.

The answer is not more data or more hardware acceleration, but smarter software which mimics human-like reasoning - to reduce data volume and complexity to focus on that 1% that is relevant to making decisions; to be able to cross-reason with multiple modalities of data, information and knowledge in whatever format this takes; to be able to perform complex reasoning tasks to elucidate answers even when there is little or no data or very weak sensory signals or competing priorities and conflicting data using multiple strategies and decision processes derived from knowledge - whether this be in the form of prior knowledge, domain expertise, reasoning from first principles and codified skills and good old common sense.

This requires combining traditional AI/ML models - which are data-driven and are premised on statistical probabilities and pattern matching to predict the next word, image, text or outcome using lots of data examples - with multiple symbolic representations of knowledge, domain expertise, skills, and wisdom to offer truly multimodal neuro-symbolic AI solutions.

We propose a national initiative to research multimodal neurosymbolic solutions which can perform complex reasoning, have dynamic memory retrieval and complete, real-time situational awareness. Cognitive processes enable self-awareness, common-sense which leverages knowledge not data to discern insights and wisdom - doing much more on less hardware, less bandwidth and all explainable and accountable. Combining the best of numerical, data-driven AI/ML models with symbolic representations of knowledge (which can be now be autogenerated and tested and applied using real-time data and ML feeds instead of the old handcrafted rules based systems of old to generate execution focused knowledge bases as an enhancement to knowledge graphs) in multi-strategy complex reasoners which are power, memory and processor efficient so that they can function independently at the extreme edge (i.e. autonomous systems) is what we see as the future of AI. All the components are available now - we just need a concerted effort and funding to bring it all together. AGI without complex reasoning, self-awareness, and codified domain expertise, knowledge and first principles across multiple disciplines will not happen. This research and development however will go a long way to making this possible.
