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DIGITAL
ALTERNATIVE THINKING ABOUT INVESTMENTS

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Why EnCharge AI? Revolutionizing AI Compute with In-Memory Computing

It can be said that artificial intelligence ("AI") is limited by three factors - accuracy, speed, and energy. Accuracy improves with better algorithms, as seen in the different versions of GPT that OpenAI has offered and the improvements within them. The speed and energy usage are functions of models and the semiconductor devices upon which the models are operated. Over the last decade, we have seen AI inferencing semiconductors advance from CPUs (e.g., Intel) to GPUs (e.g., Nvidia), ASICs (e.g., TPUs by Google), and so on. Each step in this evolution has involved some degree of specialization. CPUs, meant for running general-purpose programs and operating systems, were first used for AI's mathematical operations. Later, GPUs were used as GPGPUs (General Purpose GPUs) since the vector mathematics of graphics (the G in the GPU) aligns nicely with the tensor math of AI. ASICs were then designed solely for AI math. However, all these technologies contain a familiar premise of computation involving data movement from memory into the computational circuitry.

Core Technology and Competitive Edge

The next step in the evolution of AI chip design is where the computation occurs directly within memory. This computation paradigm is called in-memory compute (IMC) or compute in-memory (CIM). Encharge AI ("EnCharge") is a firm that operates in this space. The movement of data from storage to memory before it can be computed consumes additional energy and adds to the time it takes to perform the computation. EnCharge AI's solution significantly reduces this data movement. IMC is analogous, to a degree, to the commute to the office before a human being begins the actual work process. The idea of performing the computation directly within the memory unit was challenging because of, among several things, the instability via noise introduced into the computation process. By using an innovative and patented analog design architecture that it has invented and refined since 2015, EnCharge AI bridges this gap between, on the one hand, the speed and power-efficiency of in-memory computing that can be gained and, on the other hand, the stability that is needed from that same compute. Refinement, stability, and proximity to commercialization of this technology have been obtained by work done over approximately a decade involving a new hardware architecture and a software stack around the hardware to catalyze rapid adoption.

At the heart of EnCharge AI's technology is its switched-capacitor in-memory computing (IMC) platform, which integrates computation directly into memory storage

units. This approach drastically improves energy efficiency and processing speeds, thus making it better suited for AI models that require low latency and real-time performance. This approach is particularly valuable for consumer electronics (laptops, mobile phones), edge devices (automobiles), defense agencies requiring rapid AI processing at scale, and even for enterprises (data centers).

EnCharge leverages the existing semiconductor supply chain and integrates into a wide range of form factors—from chiplets and ASICs to PCIe cards—enabling seamless AI capabilities across various industries. The company's AI acceleration solutions have the potential to outpace conventional GPU hardware by over 20x, offering an impressive 150 TOPS/W compared to the industry average of 5-10 TOPS/W.[1]

The core team of EnCharge has been working in this space since 2015 as part of Princeton University and with funding from DARPA. The firm itself was formed in 2022 and endowed with the relevant patents and technology to facilitate commercialization. As a first step in its multi-year plan, the firm has built relationships with OEMs to supply their chip within laptops and other such devices for environments with limited power availability (e.g., less than ten watts as opposed to a data center server that can use several kilowatts). AI inferencing can be done for client device workloads such as graphics creation and editing, gaming, and personal agents. The firm then plans to expand its product into edge devices such as automobiles and other client devices.

Conclusion:
We believe EnCharge is poised to tap into the rapidly expanding AI market, projected to reach $18 billion in AI PC computing alone by 2027[2], with its scalable, energy-efficient, and high-performance AI computing solutions. Backed by a strong patent portfolio and strategic partnerships, we welcome this addition to our Morgan Creek Digital Fund IV, LP. portfolio.

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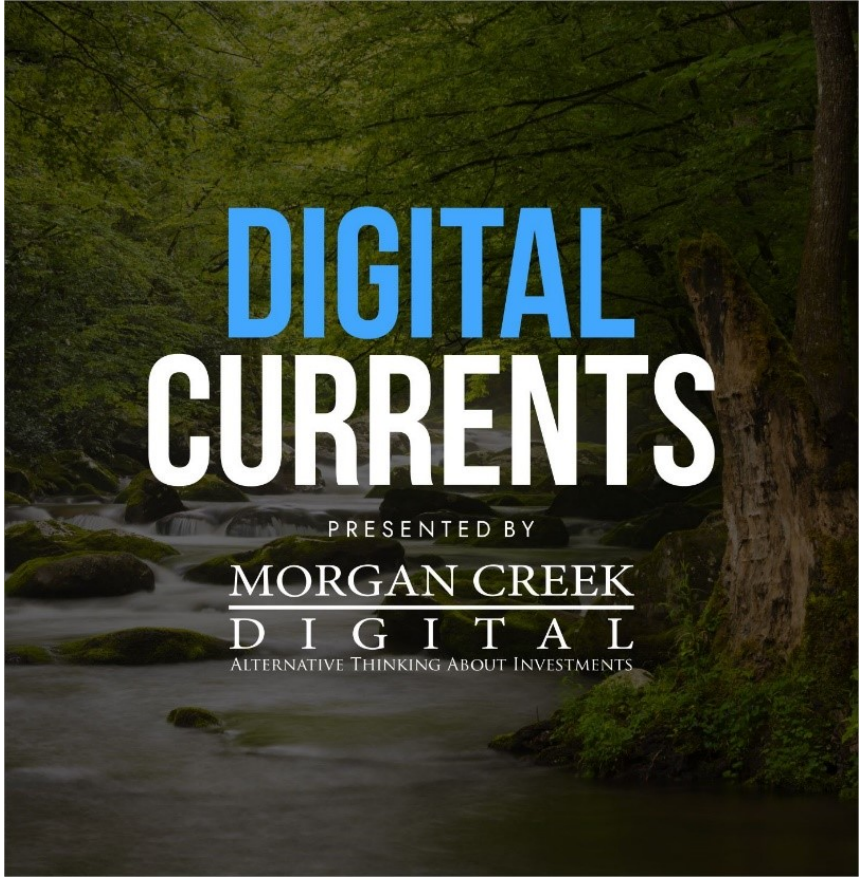

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[1] Information provided by EnCharge AI management.
[2] https://www.alliedmarketresearch.com/artificial-intelligence-market

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