Lifelong learning will power next generation of autonomous devices

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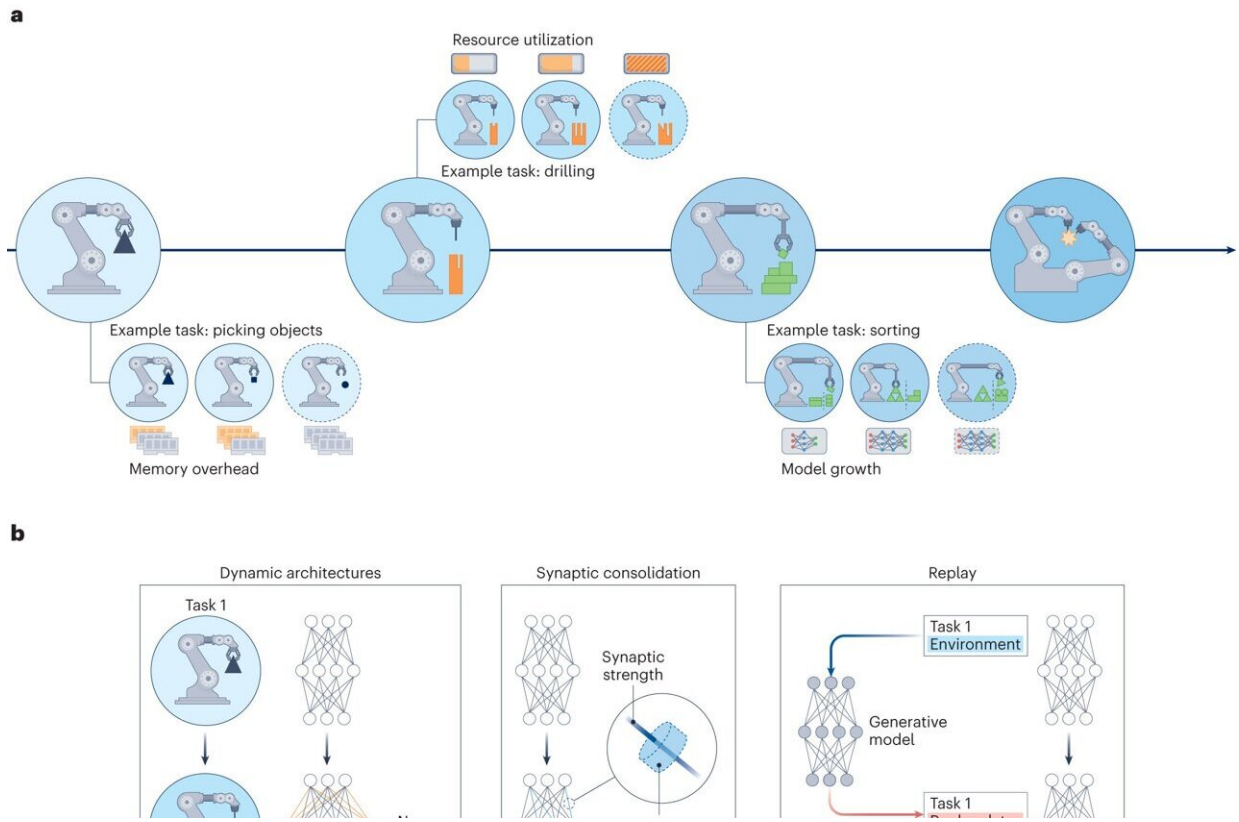

Addressing lifelong learning in AI systems. a, Applications: lifelong learning shown in the context of sequential tasks (large circles) and sub-tasks (smaller circles) with varying degrees of similarity, and the associated hardware challenges. b, Algorithmic mechanisms: a broad class of mechanisms that address lifelong learning. Dynamic architectures either add or prune network resources to adapt to the changing environment. Regularization methods restrict the plasticity of synapses to preserve knowledge from the past. Replay methods interleave rehearsal of previous knowledge while learning new tasks. c,

Hardware challenges: lifelong learning imposes new constraints on AI accelerators, such as the ability to reconfigure datapaths at a fine granularity in real time, dynamically reassign compute and memory resources within a size, weight and power (SWaP) budget, limit memory overhead for replay buffers, and rapidly generate potential synapses, new neurons and layers. d, Optimization techniques: hardware design challenges can be addressed by performing aggressive optimizations across the design stack. A few examples are dynamic interconnects that are reliable and scalable, quantization to