Neuromorphic Application Assessment

The purpose of this assessment is to determine (a) if the proposed application is sufficiently well defined, (b) if the value that neuromorphic technology can provide is well understood and compelling, (c) if the practical requirements of the application can be satisfied with algorithms, software, and systems available today, and (d) the likelihood of demonstrating an unambiguous state-of-the-art solution.

Application definition and requirements

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| WHAT | What is the task? | | *Please provide a concise high-level description of the application.*  *Are there any references to learn more about the task?* |
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| What are the key computationally hard components of the task? | | *Examples might be DNNs, ML algorithms, standard optimization objectives (LASSO, QUBO, MLIP, graph search, etc.) If non-standard, please provide a mathematical description or references to computational problem. What proportion of the task’s hard computational components will be solved neuromorphically?* |
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| WHY | What is the impact of solving the task? | | *Articulate in terms of value to the end user/customer. Why will anyone care that this task is successfully accomplished?* |
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| Is there already an existing market or a path to commercialization for this application? | | *Who are the customers? What is the path to commercialization? Any obstacles or recent enabling developments? What is the size of an existing market?* |
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| How generalizable or broadly applicable is a solution to this task? | | *How easy is it to generalize the task to other domains?*  *What else could a superior implementation to components of the task be applied to?* |
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| REQUIREMENTS | What are the key metrics to assess the performance or quality of this task? | *Examples could be energy or time to solution, accuracy or result with respect to some reference, area, cost.* | |
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| Are there critical data IO, throughput, latency, closed-loop requirements? | | |
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| Are there requirements on setup time? | *Setup time may include compiling a program or model, loading it onto a HW platform?*  *If the application is typically launched once and executed for a long time, then the answer is likely no. If otherwise, please explain.* | |
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| What degree of programmability or flexibility is required by the HW compute platform? | *Does the task require the flexibility of a general-purpose CPU to maximize developer productivity or satisfy other constraints or is the task best served by a custom ASIC or anything in-between?* | |
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| Does the task require any real-time adaptation? | *Is the program or model entirely pre-configured or pre-trained before deployment or does it have to adapt after deployment by itself based on data?*  *What type of adaptation is required? Backpropagation or other learning rules?* | |
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Proposed implementation and state-of-the-art baseline

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| HOW | What neuromorphic methods will be used to solve the task? | *What algorithms, software, and other critical neuromorphic ingredients will be used? Please provide references wherever possible.* |
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| How mature are these methods; what exists today versus what needs to be invented/proven? | *Have the necessary algorithms been modeled successfully to date? Have they been mapped to neuromorphic hardware and shown to work at the scale demanded by the application? Have all application precision requirements been considered? Do the relevant Lava software modules exist today? Are the modules interoperable/composable?* |
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| COMPETITION | What competitive state-of-the-art solutions exist today, if any? | *What are critical performance metrics? In what way are current solutions state of the art with respect to all or some metrics?*  *Does the proposer have access to a working reference implementation to the problem based on conventional systems?* |
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| What are the limitations or major pain points of current solutions? | *How and why are they insufficient? In what way do current solutions not address the desired key metric requirements?* |
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| How will the neuromorphic solution be evaluated against other solutions? | Are there standardized benchmarks to evaluate the proposed solution versus state-of-the-art alternatives? *If so, please describe and provide references if possible. If not, how will success be defined?* |
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