IVAPP 2022 - Paper #30

Paper Title: *SIMDGiraffe : Capturing and Visualizing the Expert's Mind to Understand SIMD Instructions*

Reviewer *#1*

General Assessment (Please assign scores using the following criteria (1=weakest; 6=strongest))

Relevance (Paper fits one or more of the topic areas?): 3
Originality (Newness of the ideas expressed): 4
Technical Quality (Theoretical soundness/methodology): 3
Significance (Is the problem worth the given attention?): 4
Presentation (Structure/Length/English): 4
Overall Rating (Weighted value of above items): 2

Improvement Suggestions (for authors to consider in the camera-ready version. Additional detail in "Observations")

Abstract and Introduction are adequate? Yes
Needs more experimental results? Yes
Needs comparative evaluation? Yes
Improve critical discussion ? (validation): Yes
Figures are adequate ? (in number and quality): No
Conclusions/Future Work are convincing? Yes
References are up-to-date and appropriate? Yes
Paper formatting needs adjustment? Yes
Improve English? No

Detailed comments to authors, including aspects that must be improved in the camera-ready version of the paper:

The authors propose a system to visualize SIMD instructions as offered by many modern CPUs in a unified way rather than textual descriptions as offered by vendor manuals, with the goal to support novices in understanding how these instructions work, therefore the link between inputs, operands and the output.

The proposed visualization is based on an abstraction of the SIMD instructions and data types (arrays), which allows expert users to enter formulas for the elements of the abstract arrays, which are then displayed as text. This decision seems to be based on previous bad experience with graphical representations based on oriented lines with operators on top, failing to represent SIMD instructions involving operands depending on other operands.

This somehow disqualifies this paper for a visualization conference, but is not the only reason why I think this paper should not be accepted in its current form:

I found previous work by probably the same authors also intruducing a tool named SIMDGiraffe, which presents a graphical tool for visualization of more complex SIMD functions.

This naming is unfortunate, since the tools do not seem to be closely related. Apart from this the previous world should have been included in the references and the differences should have been discussed.

I am not convinced by the idea to expand data dependent instructions like instructions involving mask operations, since the resulting expressions might become very long and again hard to understand. I would good to have some sort of categorization of the instructions available and examples for the resulting expressions/their maximum length as part of the experiments discussion.

The examples presented are not too convincing for me. For the instruction in Fig.3 I found pseudocode more intuitive than the formula. In Fig.4 I see a slight advantage of the presented method.
I would recommend a user study to clarify, whether the proposed method outperforms the description and pseudo code and whether users like it.

I tried to use the tool online, but could not reproduce the results shown. The tool did not display the formulas in both the novice and the expert view. I was also not able to obtain results for instructions I tried to manually enter. For me the web interface was not very intuitive. It would greatly benefit from, e. g. drag and drop techniques for operands and operators.

The paper itself is generally well written, although it is missing structure.
Besides, the quality of the figures is suboptimal. There are artifacts due to the magnification of small screenshots (Fig. 2 and 3) On the other hand the operator and operands in Fig.4 are not legible, because they are too small.

IVAPP 2022 - Paper #30 Meta-Review

Paper Title: *SIMDGiraffe : Capturing and Visualizing the Expert's Mind to Understand SIMD Instructions*

Reviewer *#2*

General Assessment (Please assign scores using the following criteria (1=weakest; 6=strongest))

Relevance (Paper fits one or more of the topic areas?): 3
Originality (Newness of the ideas expressed): 4
Technical Quality (Theoretical soundness/methodology): 4
Significance (Is the problem worth the given attention?): 3
Presentation (Structure/Length/English): 4
Overall Rating (Weighted value of above items): 4

Improvement Suggestions (for authors to consider in the camera-ready version. Additional detail in "Observations")

Abstract and Introduction are adequate? Yes
Needs more experimental results? Yes
Needs comparative evaluation? Yes
Improve critical discussion ? (validation): Yes
Figures are adequate ? (in number and quality): No
Conclusions/Future Work are convincing? No
References are up-to-date and appropriate? Yes
Paper formatting needs adjustment? No
Improve English? No

Detailed comments to authors, including aspects that must be improved in the camera-ready version of the paper:

The authors propose a system to visualise SIMD instructions as offered by many modern CPUs in a unified way rather than textual descriptions as offered by vendor manuals, intending to support novices in understanding how these instructions work, therefore the link between inputs, operands and the output. The proposed visualisation is based on an abstraction of the SIMD instructions and data types (arrays), which allows expert users to enter formulas for the elements of the abstract arrays, which are then displayed as text.

All reviewers agree that this paper is generally well written, comes with enough references.
R1 and R2 think this paper doesn't fit a visualisation conference well.
For R1, the contributions remain unclear due to no solid evidence.
R2 is not convinced by the idea to expand data−dependent instructions like instructions involving mask operations since the resulting expressions might become very long and again hard to understand. Also, R2 found previous work by probably the same authors also introducing a tool named SIMDGiraffe, which presents a graphical tool for visualisation of more complex SIMD functions, and the tools do not seem to be related. R2 tried the online tool, and it could not reproduce the results. R2 recommends a user study to clarify whether the proposed method outperforms the description and pseudocode and whether users like it.
R3 believes that there are two main issues with the paper. The first is that Section 4 is a block of formal mathematical explanation of how operations and data can be abstracted. It seems particularly jarring as the

paper is about explaining graphically to novices concepts that may be hard to grasp formally − and visualisation paper reviewers tend to be novices in mathematical notation but experts in understanding graphical concepts! This should either be explained with a couple of annotated examples, moved to an appendix if allowed, or left for a paper to a more mathematically inclined audience (and use the saved space for more discussion of the interface design and what the expert user did and contributed). The second issue is that the final interface doesn't seem particularly visual. There is an entire section on visual design etc., but the final interface appears to be a program listing, some dropdown boxes and a small table of operators, data and results. Suppose this is all that is needed, state clearly why this is sufficient. R3 also suggests a novice user get involved in experiments.

Based on comments from three reviewers, this paper is not recommended to publish.

IVAPP 2022 - Paper #30

Paper Title: *SIMDGiraffe : Capturing and Visualizing the Expert's Mind to Understand SIMD Instructions*

Reviewer *#3*

General Assessment (Please assign scores using the following criteria (1=weakest; 6=strongest))

Relevance (Paper fits one or more of the topic areas?): 5
Originality (Newness of the ideas expressed): 3
Technical Quality (Theoretical soundness/methodology): 3
Significance (Is the problem worth the given attention?): 4
Presentation (Structure/Length/English): 2
Overall Rating (Weighted value of above items): 3

Improvement Suggestions (for authors to consider in the camera-ready version. Additional detail in "Observations")

Abstract and Introduction are adequate? Yes
Needs more experimental results? No
Needs comparative evaluation? No
Improve critical discussion ? (validation): Yes
Figures are adequate ? (in number and quality): Yes
Conclusions/Future Work are convincing? Yes
References are up-to-date and appropriate? Yes
Paper formatting needs adjustment? No
Improve English? Yes

Detailed comments to authors, including aspects that must be improved in the camera-ready version of the paper:

This paper describes a formalism and interface for communicating the actions of vector−based processing instructions between an expert and a novice parallel programmer.

The english is generally good, needs minor finessing at some points, though throughout the paper 'dial' seems to have been copy and replaced for 'panel'. References seem ok, with software visualisation well represented, and the figures are a faithful representation of the system.

There are two main issues with the paper. The first is that Section 4 is a block of formal mathematical explanation of how operations and data can be abstracted. It seems particularly jarring as the paper is about how to explain graphically to novices concepts that may be hard to grasp formally − and visualisation paper reviewers tend to be novices in mathematical notation but experts in understanding graphical concepts! This should either be explained with a couple of annotated examples, moved to an appendix if allowed, or left for a paper to a more mathematically inclined audience (and use the saved space for more discussion of the interface design and what the expert user did and contributed).

The second issue is that the final interface doesn't seem particularly visual. There is an entire section on visual design etc but the final interface appears to be a program listing, some dropdown boxes and a

small table of operators, data and results. If this is all that is needed, state clearly why this is sufficient.

It is good that an expert user was involved in the construction of the interface. However it would be even better to have a novice user interpreting the results as well to show the interface achieves its goals (do they understand the novice view of the data, does it help them bridge to the expert's view)?

In summary, this is interesting work − understanding of parallel processing, and bridging the gap for novice users is a real issue, and software visualisation could help with that. However, I feel it's not ready for publication yet, it needs validation from the novice side and more exploration / development of the visualisation itself. Also, section 4 needs re−thought as to its utility in a visualisation −oriented paper.