SAARLAND/INTEL JOINT PROGRAM ON

THE FUTURE OF GRAPHICS AND MEDIA

REQUEST FOR PROPOSALS

1. SUBJECT

Under the Saarland/Intel Joint Program on **The Future of Graphics and Media** Saarland and Intel request proposals that address the increasing compute complexity in creating, processing, encoding, and rendering of visual content supporting the spectrum of real-time, distributed, immersive and interactive visual experiences.

The research will explore novel algorithmic techniques, system- and HW-architectures, and co-design across domains to achieve orders of magnitude improvement in rendering complexity, media processing, and content creation while improving the quality, performance, or both.

2. KEY DATES

Information session for proposers:

Saarland and Intel program staff will be available for a conference call (call details including date, time and meeting link to be shared) to answer questions and provide additional clarifying information regarding the RFP. Additional calls might be scheduled on request.

Proposal Submission Deadline (PIs): Sep 25th, 2023, 23:59 CEST.

Proposal Responses from Saarland and Intel: Oct. 13th, 2023, EODCEST

Planned Research Start: December 2023

3. OVERVIEW

In the post-pandemic era, visual content is growing exponentially, and this has led to a >100× increase in bandwidth, compute, and storage. Furthermore, the continuous demand for higher quality visual experiences as well as the real-time streaming across the E2E infrastructure (clients ⇔ cloud/edge) requires research in re-imagining the graphics/media pipeline with AI techniques and new representations for capture/creation, processing, rendering and distribution.

To address these challenges, Saarland and Intel invite **proposals from academic researchers** to explore alternative representations of visual information targeting >100× compression, >100× reduction in rendering complexity, and support for live high-quality content. We envision alternative representations and generative techniques to enable highly interactive, live, and immersive experiences and drive the next generation of visual standards. Apart from technical advancement, Intel and Saarland expect that this research will have a significant **social impact by reducing carbon footprint of visual data processing** as it is expected to grow exponentially over this decade.

4. PROGRAM SCOPE AND FUNDING

Saarland and Intel fund a new collaborative, multi-year research program addressing the three **Research Vectors (RVs)** described in detail below. Each submitting organization should focus their proposal on one or more of these research vectors (in line with their primary expertise) and identify key contributions that are expected. We envision that PIs might form teams collaborating on related topics across different research vectors. In this case please still submit separate proposals and indicate that it is a part of a team.

RV1: Alternative Representations for Media/Graphics
Novel solutions that transform visual data into compact alternative spaces that maintain spatial, temporal, and semantic consistency as well as an efficient mechanism to capture spatial and temporal redundancies, etc.

Alternative (e.g., latent space) representations of visual information could help achieve: A) >100× compression over current state-of-the-art media compression while retaining perceptual visual quality across different content; or B) new AI models/algorithms for replacing parts of the graphics and visual computing pipeline (e.g., rendering primitives, materials, ray tracing, etc.), or collapsing complex chained computations not only for single tasks (e.g., complex shaders condensed into a block with fixed computation and memory complexity) but especially for aggregate behavior or appearance otherwise created by the interplay of many individual items (e.g., grass blades, hair strands, sand grains, pebbles) resulting in consistent, temporally stable, high-fidelity output, while approaching real-time, low latency, fixed compute and memory complexities, that delivers >10–100× efficiency improvements. We expect the learnable components to enable interpretability, provide scalability and generalizability.

RV2: Generative/Neural Techniques for Content Creation and Streaming
Robust generalized representation of visual data must allow: A) 3D control to manipulate information in an alternative space that will improve authoring (content creation) time and significantly reduce run-time complexity (e.g., new models for content creation, 3D reconstruction, usage of pixel versus frequency domain, differentiable rendering, global illumination, etc.) resulting in >10× reduction in latency and increase in throughput within power envelopes of next generation of graphics products; or B) on the fly adaptive encoding techniques to optimize quality and bit-rate trade-offs and adapt to changing network conditions and different streaming media content types to support a balanced user experience in an alternative space.

RV3: E2E Systems Design for new representation & generative approaches
Research in novel distributed system architectures from endpoint (low-power devices becoming primary point of accessing emerging graphics/media applications) to edge/cloud infrastructure that are designed for an alternative representation of immersive visuals, that enable efficient storage and support optimized graphics & visual computing pipelines based on generative techniques. Driving applications could include improving digital humans rendering and realism in usages such as metaverse, crowd simulations and synchronization in multi-user worlds, predictive agent prediction, and integrating AI to improve avatar generation, etc. Explore SW/HW co-design methods to deliver real-time performance for future high quality, high resolution (e.g., 12k/8k/4k) of various visual data types.

To drive innovative next generation designs and solutions Intel will consider providing access to computing resources such as discrete graphics (Arc/Max/Flex), Intel Xeon servers, and XPU (e.g., FPGAs). Thus, such research will not only help drive next generation of media representation standards and new graphics/AI and media IPs but have broader societal/environmental impact (e.g., by reducing carbon footprint, enabling new technology-based experiences never possible before).

5. PROPOSAL FORMAT

Please note that Saarland and Intel are unable to receive proposals under an obligation of confidentiality. All proposals submitted should therefore include only public information. Proposals submitted to the Saarland/Intel Joint Programs and corresponding unattributed review materials from the Saarland and Intel merit review process will be shared with the other Party for the purposes of their review, as well as for subsequent discussion by Saarland and Intel as part of the selection process for the Saarland/Intel Joint Programs. In its review, Intel will share proposals with appropriate Intel personnel at its discretion.

Proposals should be **3–6 pages**, not including citations or the cost volume. Saarland and Intel recommend defining a project for one Principal Investigator (PI) for up to three years. The project plan might include a fourth year, but initial funding will be limited to (and hence major results should be achieved after a maximum of) three years. Researchers except PI's are expected to be fully dedicated to a project and hence can be part of only one proposal.

Each proposal should comprise the following sections:

1. **Proposal cover page (max 1 page):**

   a. **Organization**
   b. **Name of PI and the main contact person**
   c. **List of team proposals and team PIs**
   d. **List one or at most two targeted research vectors**
   e. **Executive summary** including intended outcomes. Summarize the key elements of the proposal.
2. **High-level motivation, preliminary results, approach, and proposed goals for the research questions (≤ 3 pages)**: Briefly describe the motivation for the proposed project, preliminary results, techniques (especially novel ones) that underpin the approach, and the plan of tackling the proposed research questions. Summarize what will have been accomplished after three years if all goes according to plan. Be sure to detail the current state-of-the-art for the proposed technology (or nearest related technologies). This section must also include an explicit statement of the Intellectual Property (IP) status for all background IP related to this technology (i.e., are the intellectual property rights to this technology protected, and if so, who owns those rights). Saarland/Intel Joint Programs awardees with projects that generate data or software in performing the work under an award will agree, as a condition of the award, not to incorporate any third-party code or background IP, except by separate, fair, reasonable, and non-discriminatory prearrangement with Saarland and Intel, into this software that would limit or restrict its ability to be distributed under an open-source license.
3. **Statement of work, schedule, milestones, success criteria and deliverables (≤¾ page)**: For each of the goals addressed, outline the three-year scope of the effort including tasks to be performed, schedule, milestones, deliverables, and success criteria. It is understood that aspects of this research effort may be exploratory in nature and schedules/deliverables reflect intentions rather than a firm commitment.
4. **Personnel plan and expertise statement (max ¼ page per researcher)**: Include a list of key personnel plus a statement on each person's role and time commitment. For each person, please add a brief bio or web page link and list their five most relevant prior publications (within the last five years) for the selected research questions.
5. **Student plan (≤1 page)**: In light of Saarland and Intel's strong commitment to diversity and creating an inclusive environment, please address: (a) your organization's commitment to diversity and inclusion with respect to race, national origin, gender, veterans, individuals with diverse abilities and LGBTQ, (b) a summary of your performance in this area and any initiatives you are pursuing, and (c) the diverse team you propose for this project, and information about the PhD students and postdocs you envision to assign to this project (if known). Outline the approach and plan whereby PhD students will be recruited and incorporated into the team, and any plans for encouraging/supporting those students in collaborations with Intel (e.g., availability for Internships should a mutually interesting opportunity arise). If the PIs have a pre-existing relationship and history of student hiring by Intel, please discuss issues/plans/ideas to continue or strengthen that connection.
6. **Prior Intel Collaborations (max ¼ page per project)**: If you collaborated with Intel in the past, please list the project/institute, the year, and the main contact(s) at Intel. Furthermore, add a short abstract outlining the scope. However, previous collaborations with Intel are not a precondition for proposal submission and will not be considered in the evaluation.
7. **Past Successful Technology Transfers (≤1 page)**: Evidence of past successful industry collaborations and technology transfers. Examples include startups, products, and other evidence of tangible business impact of the involved academics.
8. **Budget and Financials (max ½ page)**: Typical grants are €80k–€300k per year for three years (with a potential extension to a fourth year after review). The work will be carried out under an Open Intellectual Property model (results are published, code is open sourced and licensed w/o copy-left). Our goal is to maximize the available research ideas given a fixed amount of total funding. Academic institutions may propose how to achieve this. Please also indicate how many researchers (FTE; full-time equivalents) can contribute their research for the proposed funding.
9. **IP-compatible funds amplification (no limit)**: If the team can obtain funding for related work from other sources (including the academic institution itself) and the sponsor commits to follow a public dedication approach for that project, the team may list funding that would be considered to amplify the proposed project.
10. **Citations (unlimited)**

11. **Cost volume (unlimited)**: Cost proposal in Excel or another format as appropriate (Personnel costs, material costs, overhead costs and the total cost volume must be shown individually) Note: The submitting organization may be asked to submit revised budgets to Saarland and Intel tailored to each Party's investment.

6. EVALUATION CRITERIA

In order of importance, the evaluation criteria for this solicitation are as follows:

1. **Potential contribution and relevance to Intel, the broader industry and society**: The proposed research should directly support a technology solution that addresses the RVs outlined above, leading to technological advances with the potential for ongoing technology transfer in collaboration with Intel and the broader industry and to support societal transitions anticipated in the near future.
2. **Technical innovation**: Proposed solutions of interest should clearly push the boundaries of technical innovation and advancement. Research that is not of interest in this program includes incremental advancements to state-of-the-art and current design practices. Feasibility of new algorithms/techniques should be demonstrated through SW/HW implementations.
3. **Clarity of overall objectives, intermediate milestones, and success criteria**: The proposed Research Plan should clearly convey that the PIs have the knowledge and capability to achieve the stated research goals. It is understood that any research program will have uncertainties and unanswered questions at the proposal stage, but a clear path forward in key challenge areas must be identified and justified. Teams are expected to demonstrate progress toward project goals at quarterly milestones. As detailed in "Program Scope and Funding" section, the proposal should explicitly point out which RV is being addressed, the synergy among them if more than one RV, the plan and milestones towards building research prototypes, plan for ongoing technology transfers, and the anticipated proof of concept outcome. Strength of project management will also be considered.
4. **Qualification of participating researchers**: The extent to which expertise and prior experience bear on the problem at hand. Please elaborate on track records of building research prototypes (e.g., open-source research code/collaterals on GitHub) and resulting publications from past relevant projects.
5. **Cost effectiveness and cost realism**: The extent to which the proposed work is both feasible and impactful within the proposed resource levels will be examined.
6. **Potential for co-funding**: Opportunity for closely synergistic matching grants and co-funding with other funding entities, such as DFG, BMBF, BMWK, EU, etc. will be given significant consideration.
7. **Potential for broader impact**: Saarland and Intel expect the academic community to be strong partners in creating values and commitments to diversity, sustainability, and education. They support the advancement of computing education and diverse participation in STEM. Proposals are encouraged to elaborate on how the proposed work is anticipated to impact student education on campus and/or the broader academic community.

7. PI MEETINGS AND COLLABORATION STRUCTURE

Intel will be deeply engaged with the program and assign Intel employees to collaborate and partner across RVs to interact with the academic community to produce a stream of innovation proof-points, publications, demonstrations, and technology transfers throughout the duration of the program. We aim for the interaction to be bi-directional where Intel collaborators are part of the research team. Not only will they provide research feedback, but they will also actively contribute and co-develop the research to amplify the program outcome and enable continuous technology transfers.

It is expected the PI and researchers of each project will collaborate on a daily or weekly basis. Where deemed valuable, monthly PI, student and Intel collaborator meetings will be used to present significant updates, and provide feedback

Semi-annual face-to-face or virtual meetings will be held to facilitate program-wide information exchange, and discussion of research. Researchers should anticipate one annual face-to-face meeting to be held at an Intel site in Germany or close to the German boarder or a site of mutual agreement in

Saarland. Associated travel costs for the annual face to face meeting should be considered and included in the proposed budget. In the event unexpected travel restrictions prohibit a face-to-face meeting, a virtual meeting will be held.

Intel will offer free access to Intel's Academic Compute Environment, a resource for academia researchers in the program to exercise their workloads on Intel's latest hardware, as well as internal large compute resources will be made available to academic PIs to accelerate development, as appropriate.

For those researchers who are already funded and seek collaboration opportunities with Intel and other researchers in the area of this RFP, please let us know. One option is to participate in program activities (e.g., seminars, workshops, and hardware access) without Intel funding.

8. ELIGIBILITY

The program is solely open to all researchers and institutions based in Saarland. Any questions regarding eligibility should be directed to the Saarland and Intel team contacts (see below).

9. INTELLECTUAL PROPERTY

Saarland/Intel Joint Program awardees will agree to dedicate to the public all intellectual property created from the research funded under a Saarland/Intel Joint Program and to distribute all source code that has been authored while working on a Saarland/Intel Joint Program award under a Berkeley Software Distribution (BSD), Apache, or other equivalent open-source license. Software licenses that require as a condition of use, modification and/or distribution that the software or other software incorporated into, derived from, or distributed with the software be licensed by the user to third parties for the purpose of making and/or distributing derivative works are not permitted. Licenses that are not appropriate, include any version of GNU's General Public License (GPL) or Lesser/Library GPL (LGPL), the Artistic License (e.g., PERL), or the Mozilla Public License. Exceptions to this policy may be granted by Saarland and Intel to address the problem of participation in established open-source software projects or standards already licensed under GPL, LGPL, or other copyleft open-source licenses.

10. SAARLAND AND INTEL TEAM CONTACT INFO

The following individuals from Saarland and Intel are actively involved with the Saarland/Intel Joint Programs (**potentially to be adapted once program manager is determined**):

Sabrina Kriewald	s.kriewald@wissenschaft.saarland.de
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Please send proposal submissions and related inquiries to the above contacts; and please include "RFP Saarland/Intel Joint Program Future of Graphics and Media" in the Subject of your email.