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| **Summary** |  |
| **Partner name** | Ubisoft Toronto (https://toronto.ubisoft.com/) |

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| **Research project** |  |
| **Project title** | **Precise clustered light tile culling for large/infinite light volumes** |
| **Project description – research description** | In a standard deferred renderer, pixels inside a light volume (sphere/cone/capsule) are used to define which lights are used in the BRDF integration. To limit the number of lights in the integral due to performance reasons is thus done by limiting the light volumes. This is quite crude approximation of the influence of a light to the integral.Use BRDF params (e.g. roughness, normals), light params (e.g. type/shape, brightness, shadow term), camera params (e.g. position, exposure) and potentially other parameters (e.g. other lights, participating media) to cull lights for tiles that have influence below some given perceptual threshold.* Assume clustered/tiled deferred renderer
* Efficient on GCN GPU architecture
* Generic: Works with random BRDF’s & light types
* Potential separation of diffuse & specular BRDF
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| **Research project** |  |
| **Project title** | **Anisotropic specular IBL (Split-Sum++)** |
| **Project description – research description** | Current state-of-art specular IBL uses split-sum approximation, but this is limited to isotropic BRDF convolution and thus lacks stretched reflections in grazing angles. Anisotropic materials (e.g. brushed metal or hair) can’t either be properly supported by this model.* Approximate GGX convolution
* Efficient on GCN GPU architecture
* Applicable to real-time updated cubemap
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| **Research project** |  |
| **Project title** | **Real-time Indirect Illumination** |
| **Project description – research description** | Real-time multi-bounce diffuse GI applicable to large open-world games and considering dynamic lighting changes (e.g. time-of-day, weather, different type of dynamic local lighting such as spot, omni and capsule, dynamic emissive materials) and bounce from dynamic geometry (e.g. opening doors/blinds, moving objects). Both static and dynamic geometry should receive high-quality GI and ideally issues like light bleeding would be handled without artist placed auxiliary GI volumes. The bake times should be also minimized even for large environments enabling interactive (even if approximate) multi-bounce GI updates for lighting artists. |

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| **Candidature** |  |
| **BD Contact** | Daniel Giovannini |
| **To Apply** | Interested students need to get the approval from their supervisor and send their CV along with a link to their supervisor’s university webpage by applying through the webform (*or directly to* *dgiovannini@mitacs.ca* *if posting is internal)* |
| **Notes** | More information about the program and a template for resumes are available at:[www.mitacs.ca/en/programs/accelerate](http://www.mitacs.ca/en/programs/accelerate)  |