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Final Report
CSCI 600 – Big Ideas In Computer Science

Dr. Hamed Alhoori

Dr. Alhoori focuses his research on topics related to Big Data, focusing on aspects of reproducibility and impact of research papers. The main problem right now in the scientific community is that there are so many research papers published, and more than half of them is not reproducible due to lack of source code released from the author, or lack of specifics to solve the problem.
One of the main focus of his research is to try to define a way to understand how much a research article is impactful for the society.
The funding instantiated by the NSF and the NIH are limited, and so we should have a way to determine how well the money have been spent on research.
Common metrics to determine the impact is to check the number of citations an article receives, but this takes time to accumulate. So people started to come up with different metrics on how evaluate the impact.
Things like the number of pdf downloads, number of reads, publishing venue etc.
All those kind of attributes classify as altmetrics (alternative metrics) , and through them it's possible to predict if an article will receive a citations or not, so using metrics available immediately to predict a slower growing metric, like the number of citations received

Dr. Michael Papka

Dr. Papka focuses his research In different fields,most of them in topics of High performance computing, Data visualization and Virtual reality.
He explained us the different stages of his career, and what drives his research passion. He explained how he uses the VL3 volume rendering library to extract 3D objects from data, and how the visualization of data in a 3D environment could positively affect, something like data analysis.
He showed us real life application of problem that he got to solve during his career, in collaboration with Argonne National Laboratory, Fermi National Accelerator Laboratory, and other universities around the world. He exposed us to the concept of virtual reality and augmented reality, analyzing what is currently available, and what need to be improved, with possible research path for a student to go through. He explained how what was before really expensive, in term of monitor resolution, or hardware equipment, today is easily accessible, as gaming rigs and VR equipment like the Oculus makes this technology accessible to everyone. Said so, in the VR world, what we want to do is to give to the user an immersive experience, and to do so, the environment needs to be highly responsive. For this reason we won't simulate every aspect of the environment with maximum resolution, but we will use maximum resolution for what is close to us, and lower resolution for the background, to give us a context of where we are. Another project he focused on, was the possibility to display different information with a window in a window pattern, so representing simulation data on a big screen, and through external devices like a smartphone or tablet, being able to reproduce to different data, for the same location pointed by the device camera. Other aspect of the research was focused on high performance computing. On how this technology allows scientists to access to information, reducing the time needed for doing science. Problems still to tackle, are live representation of the simulation processes, so to have a graphical status report on the status of the simulation, and other general problems with the scientific community in general, especially with the reproducibility of papers, on which he focus on the aspect that not all information is attached to papers to being able to reproduce from zero previous experiments, information that someone don't think of, like the version of compiler used, of flags used for compiling, the processor and so on.

Dr. Kirk Duffin

Dr. Duffin focuses his research on graphics.
There are 3 things that are needed in graphics and are

1. Model: as mathematical representation
2. Camera: which is involved in taking the picture
3. Images

When one of the three components is missing, it's when a computer comes into play.
It's possible in fact to reproduce a missing component, by having the other two. It's possible to create an image having the model and the camera (computer graphics), get the camera information by having the model and the image (Camera calibration), reproduce the model having info about the camera and the image (Computer Vision).
In the previous years those were all separated disciplines, but as today they are interconnected between them.
One of the topic Doctor Duffin focused his presentation on, was on how is it possible for a person, to be able to see things in more than two dimensions, when our screens are all in 2 dimensions.
The amazing part of that it's that everything is made possible through kind of an optical illusion, where by moving the projection of the axis of one of the dimensions available, the human mind reconstruct everything in a multi dimensional space. With the same concept it's possible not even to represent a third dimension but it's possible to represent an n-dimensional object, as showed from one of the tools he developed during his research.
Also, he was able to show us how is possible to efficiently represent graphically information about the boundary of states, as with the implementation of quadtree, he was able to represent information in the minimal details, and with an incredible speed.