

# Postgraduate Symposium 2019

Information Science  
Computer Science



15th October



## **Localisation for Augmented Reality at Sport Events**

**Patrick Skinner, Stefanie Zollmann**

Professional sports broadcasts often use pitch aligned graphics to provide additional information to the viewer. This is often achieved by using professional cameras equipped with high accuracy sensors or elaborate manual calibration techniques to measure the broadcasting cameras' position and orientation, allowing the graphics to be accurately matched to the camera view.

While previous research has investigated how the camera position and orientation can be estimated for professional broadcast cameras alone, none of these previous works have targeted handheld devices to provide real time augmented reality to on-site spectators.

The goal of my project is to investigate whether detected pitch markings can be used to estimate an on-site user's position and orientation with sufficient accuracy to align augmented reality content with the pitch. We use feature matching and homography estimation techniques to align a 2D geometric model of the pitch with our input image. This aligned pitch model can then be used to estimate the camera pose, allowing us to align any virtual content we wish to display to the user.

## **Situated Visualization to Enrich Sports Experience for on-site Spectators**

**Wei Hong Lo, Stefanie Zollmann, Holger Regenbrecht**

This research project presents a novel application of augmented reality (AR) for on-site spectators in live sports events. Without commentary or broadcast visualizations unlike in a live tele- broadcast, on-site spectators often lack information and statistics when they are enjoying a game. Using a combination of situated visualizations and embedded visualizations, we aim to create a mobile AR application that overlays the actual play field with live visualizations in the form of situated infographics to enrich the experience of on-site spectators. The application will use computer vision methods with a mix of 3D models to visualize what cannot be seen during the game and provide real-time information and statistics to the users, all within the viewer's mobile device. This study is part of a larger project and primarily focuses on the visualization aspect of the project, studying various possible canvases in the stadium to create visualizations. Data abstraction is also required to produce concise yet easily comprehensible visualizations within a small screen limitation. The project will initially focus on rugby in the Forsyth Barr Stadium, but we seek to make it implementable in a broader scope, including various sports and concerts in the future.

## Visual camera tracking for stationary users, methods and applications

Lewis Baker, Steven Mills, Stefanie Zollmann, Tobias Langlotz

Camera tracking can be defined as finding the position and orientation of a camera as it moves in space. It has many applications such as Augmented Reality (AR), and mobile panorama generation. In the case of panorama generation, and in some AR scenarios, the user produces a mostly rotational movement with the camera while standing or sitting in one place. This produces a camera trajectory that approximately lies on the surface of a sphere (spherical motion). It is possible to use this spherical motion assumption to reduce the complexity, and constrain the parameters of the camera tracking computations. In this talk, I will discuss the advantages of using a spherical motion constraint in camera tracking, an implementation of a Simultaneous Localisation and Mapping (SLAM) system that implements this constraint, and explore real-life applications of these kinds of constrained tracking systems.

## VIMR – Voxel-based Immersive Mixed Reality

Stuart Duncan, Holger Regenbrecht, Tobias Langlotz

Voxels can be used as an alternative form of rendering and representation for mixed reality environments, but they are not genuinely supported by modern scenegraph implementations and game engines which are designed around the paradigm of meshes. We combine the best of both worlds and present our open source framework integrating a voxel-based approach into a game engine environment for capture, rendering, replay, and telepresence experiences of mixed reality scenes based on voxels. We describe the conceptual approach, architecture, and implementation to allow developers to rapidly build coherent voxel-based immersive mixed reality experiences.

## Removing Spatial Boundaries in Immersive Mobile Communications

Jacob Young, Tobias Langlotz, Holger Regenbrecht

Though most users have migrated from desktop to mobile computing, current telepresence research continues to focus on the former, inhibiting adoption rates and ensuring consumers stick with basic solutions such as Skype and Facetime. My research aims to explore what advantages mobile computing could bring to telepresence scenarios, allowing for people to remain connected no matter where they are without the need to buy any new devices. I have so far developed two separate applications that fully utilise the portability and ubiquity of mobile phones, showing that an immersive experience may be achieved without expensive hardware. The first of these allowed distant users to explore a shared panoramic environment, which through experimentation was shown to provide a stronger sense of presence within their partner's space than conventional videoconferencing systems. The second allows users to freely explore and walk around a 3D reconstruction of their partner's

environment that is created in real time, providing an interaction metaphor that so far has been limited to powerful desktop hardware. I summarise the results of two user studies focused on these systems, providing insight on how the communication capabilities of our mobile phones could be greatly expanded.

## Toward An Acceptance Range For Using Presence Questionnaire

**Tanh Tran, Holger Regenbrecht, Tobias Langlotz**

The level of presence is evaluated to examine the effectiveness of virtual reality systems and experiments. One of the most prominent methods is to utilize post-study questionnaires. However, there are not available study figuring out how to interpret the scores of the questionnaires. Moreover, the standard for comparison between VR systems in term of presence has not been established. In this study, we review 150 studies effectively used the Igroup Presence Questionnaire (IPQ). We introduce an acceptance range for using this questionnaire to evaluate the level of presence. In addition, we also present analysis results from different experimental designs.

## Supporting Motivation for Long-term Physical Activity with Information Systems

**Wendy Wlasak, Sander Zwanenburg, Steven MacDonell, Brian Spisak**

Being physically active has many benefits for body and mind, while inactivity is associated with chronic diseases and mental ill-being. Despite this knowledge, many people struggle to transform the thought of “I should be more active” into actual behaviour. Fitness tracking devices and apps substantiate the “I should” by showing the concrete numbers. However, in doing so, these fitness aids can make physical activity feel more like a chore and that is part of the problem. Fitness trackers lead to controlled motivation, which can provide short-term behavioural modification, but not necessarily long-term adherence, good performance or well-being. What is needed is autonomous motivation, which results from feeling free and competent in what one is doing. Self-Determination Theory has been widely applied in many fields including physical activity, with promising results, but has not yet been integrated in the design of fitness tracking devices and apps. However, information technologies yield many advantages over traditional intervention approaches like wide reach, high scalability and lasting support. In my research I am therefore combining concepts from behavioural science with the opportunities information technologies offer, in pursuit of technologies that support long-term motivation for physical activity and well-being.

## Uniquely Wilf Permutation Classes

Jinge Li, Michael Albert

A permutation class  $C$  is said to be uniquely Wilf, if for every integer  $k$  and all  $n > k$ , each permutation of size  $k$  belonging to  $C$  is contained in the same number of permutations of size  $n$  that belong to  $C$ . We identify all uniquely Wilf classes that avoid a pattern of size 3. Additionally, we show that for classes that avoid no pattern of size 3 or less, there exist no uniquely Wilf-classes having three or more basis elements of size 4. The methodology used is to cast some of the necessary conditions that uniquely Wilf classes must satisfy as constraint satisfaction problems (CSPs). Computational CSP solvers are then used to rule out many possibilities. The remaining candidates can then be examined directly and proven to be uniquely Wilf.

## Prolificity in Combinatorial Structures

Murray Tannock, Michael Albert

Many combinatorial structures permit the notions of embedding and extension. Such a text is said to be prolific for a pattern if for all extensions of the text there are more embeddings of the pattern in the extension than there are in the text. Considering contexts starting with the bare set we establish some conditions on structures that permit the property of prolificity. We then shift focus to the context of compositions allowing us to establish a number of conditions on prolific compositions, including precisely stating defining sets for the class of prolific compositions for a number of different patterns. We also form methods for recognising whether a composition is prolific for a pattern and determining whether a pattern has a unique minimal prolific structure.

## Online Algorithms in Computational Biology

Lena Collienne, Alex Gavryushkin, David Bryant

A major problem of most computational methods in evolutionary biology is their inability to handle the growing volume of genomic or other omics data produced in biology. Online algorithms are methods that are able to efficiently maintain their output when the input data arrives or changes by using information from past computations. Within this talk we will focus on online versions of popular phylogenetic tree reconstruction algorithms.

One of the most popular tree reconstruction methods is the distance-based Neighbour Joining algorithm. Neighbour Joining is one of many greedy algorithms used in evolutionary biology. It is known that there are efficient online versions for many greedy algorithms. These algorithms leverage dynamic data structure to efficiently maintain the output during the course of input changes. We will consider several properties of Neighbour Joining trees and analyse the capacity of the algorithm for online perturbations.

Another widely used tree reconstruction method is Bayesian tree inference. There have already been attempts to create online versions of this method via Sequential Monte Carlo. Although promising, the accuracy of this algorithm degrades when the number of online alternations grows. We will discuss an alternative approach to online Bayesian inference build on vanilla MCMC.

## Parallel Pairwise Lasso Regression

**Kieran Elmes, Alex Gavryushkin, Zhiyi Huang**

Targeting synthetic lethal pairwise genetic interactions (where suppressing either gene does no significant harm, but suppressing both is lethal) is a promising recent approach in cancer research. We are attempting to find such interactions by exhaustively searching in large-scale siRNA perturbation screens.

While a number of existing tools could be used for this purpose, they are either inaccurate or impractically slow when used on on large and noisy data sets. We are developing a parallel lasso regularized regression algorithm and implementation, which we expect to scale to every possible pairwise interaction on the 20, 000 human protein-coding genes.

Simply parallelising a coordinate descent lasso algorithm overestimates the contribution of effects that are updated simultaneously. We are able to minimise this effect by running the algorithm simultaneously on batches of largely non-overlapping columns.

In this talk I will discuss how we find these batches and how effective they are, along with some of the implementation details that significantly improved performance. I will also present some preliminary benchmarks comparing our method to existing tools.

## Extended Bias and Variance Error Decomposition of Genetic Programming

**Caitlin Owen, Grant Dick, Peter Whigham**

The aim of my thesis is to develop and apply a framework that decomposes the error associated with genetic programming (GP) into error due to bias, internal variance (error due to the variation between different runs of the GP algorithm) and external variance (error due to the variation between different training data samples). GP is a machine learning method that imitates real-life genetics by evolving a population of program/tree structures using mutation and crossover. GP produces a different model each time it is performed using the same training set, due to a number of its characteristics including different initial populations. Analysing GP using this extended decomposition is important for gaining a greater understanding of the error due to variance associated with GP. The success of changes or additions to the GP learning algorithm can be assessed using the decomposed error, including performance in the trade-off between reducing error due to bias and error due to variance. These changes can be introduced in order to target the largest component of decomposed error and therefore reduce total error. The decomposition of error is

used to illustrate how data standardisation improves the predictive performance of GP in terms of error due to bias, but also provides challenges associated with erratic error due to internal variance. The augmentation of training data is proposed as a possible solution for stabilising prediction error.

## Predictive modelling in real estate

**Adriaan Lotter, Peter Whigham, Grant Dick, Sherlock Licorish**

Predictive modelling is often a key ingredient for making good decisions. For this reason my work is based around how we can improve the predictions of algorithms in a range of areas, such as Real Estate and Medicine. In my talk I will go over some of the work I have done around predictive modelling, as well as some of the questions we need to ask when building these models. These can range from feature engineering, modelling choice, tuning, and uncertainty analysis. I will discuss some of these topics relating to the problem of accurately predicting house prices in New Zealand, for example: ‘How do we incorporate spatial and temporal effects into our model?’, ‘How do we deal with data sparsity?’, and ‘Which tools can we use to aid us in our predictive modelling tasks?’.

## Disease-specific feature selection with Ensemble of regression methods and random forest on ECG data

**Chontira Nimcharoen, Jeremiah Deng**

Electrocardiogram (ECG) is an important tool for monitoring abnormal heartbeats. Machine learning has been used to facilitate the process of identifying the beats from the ECG data. Many focuses on the classification step while overlooking the feature selection process. Zang et al (2014), examined which features helped with identifying which diseases. They coined their method as disease-specific features selection. In this research we extended Zang et al (2014) to more features and used different classification algorithms to identify the data. We examined whether selecting and combining different features relating to the diseases with different classifications could lead to a better classification result. The finding could also inform researchers about the basic building blocks of different abnormal heartbeats. MIT-BIH was the database that was used. Random forest was used to select different features for the classification. One more feature selection algorithm was used which is the sequential feed forward feature selection with logistic regression and linear discriminant. Ensemble of random forest, logistic regression and linear discriminant were used for classification techniques. Results varies according to how features and classifications technique is combined.

## Unsupervised Domain Adaptation using Deep Networks with Cross-Grafted Stacks

**Robert Hou, Jeremiah Deng**

Current deep domain adaptation methods used in computer vision have mainly focused on learning discriminative and domain-invariant features across different domains. In this paper, we present a novel approach that bridges the domain gap by projecting the source and target domains into a common association space through an unsupervised “cross-grafted representation stacking” (CGRS) mechanism. Specifically, we construct variational auto-encoders (VAE) for the two domains, and form bidirectional associations by cross-grafting the VAEs’ decoder stacks. Furthermore, generative adversarial networks (GAN) are employed for domain adaptation (DA), mapping the target domain data to the known label space of the source domain. The overall adaptation process hence consists of three phases: feature representation learning by VAEs, association generation, and association alignment by GANs. Experimental results demonstrate that our CGRS-DA approach outperforms the state-of-the-art on a number of unsupervised domain adaptation benchmarks.

## VASE: Variational Agent’s Surprise Exploration

**Haitao Xu, Brendan McCane, Lech Szymanski**

Exploration in environments with continuous control and sparse rewards remains a key challenge in reinforcement learning (RL). Recently, surprise has been used as an intrinsic reward that encourages systematic and efficient exploration. We introduce a new definition of surprise and its RL implementation named Variational Assorted Surprise Exploration (VASE). VASE uses a Bayesian neural network as a model of the environment dynamics and is trained using variational inference, alternately updating the accuracy of the agent’s model and policy. Our experiments show that in continuous control sparse reward environments VASE outperforms other surprise-based exploration techniques.

## Can’t an AI create my presentation for me?

**Reuben Crimp, Andrew Trotman**

Last time we discussed whether "AI Agents" could write jokes, and in the limited capacity of replacing terms in known linguistic structures, it can. However we ran into the hard problem of creativity. Artificial-general-intelligence research is on the rise, the exciting possibility of Searle’s proposed Strong AI is becoming stronger. Narrow AI already plays scrabble and chess, better than all the rest, but can it compose a heart-wrenching tragic screen-play, where a grieving widow cries in rain and screams into night...? We know what it can do, and we know what it cannot, how do we bridge the gap? State of the art focuses on the vague and ill defined hard problem of consciousness, but they seemingly ignore the many other unsolved meta-cognition problems. The creative imagination is core to our mind’s function, from decision making to inducing anxiety from fearful fantasies. This process influences us both

consciously and nonconsciously, as with all other thought processes. I am proposing an artificial neural model that simulates the artificial creative imagination. Intentionally exploiting the known flaws of biological cognition, the inaccurate heuristics, the emotional processes, in-order to simulate flawed, illogical machine-cognition not dissimilar to our own.

## **Supporting Decision Making during Humanitarian Response to Crises through Reasoning about Semantics of Open Data in Humanitarian Environments**

**Aladdin Shamoug, Stephen Cranefield, Grant Dick**

In humanitarian crises decision-makers need information to guide them in making critical decisions. Finding information in such chaotic environments – where computing facilities are unreliable – is a challenging task. Therefore, decision-makers rely on domain experts who possess experience and knowledge from previous humanitarian crises to provide them with the information they need. In this research, we explore the ability of computing technologies to augment the capabilities of those experts and help decision-makers to make faster and better decisions. In this research we rely on three artificial intelligence technologies, namely: semantic web, machine learning, and natural language processing. We use these three technologies together to transform existing information from human oriented into machine friendly format, develop solutions to interpret and parse them without human intervention, and allow decision makers to retrieve required information whenever they need to. This PhD research has been started two years ago and expected to take one more years to finish.

## **Towards prioritization of app-reviews reflecting end-users' requirements for app maintenance and evolution tasks**

**Saurabh Malgaonkar, Sherlock Licorish, Tony Bastin, Roy Savarimuthu**

Requirements prioritization deals with the ranking or classification of stakeholders' requirements based on their importance. This process is central to releasing a software product with features most favoured by the product's stakeholders. Smartphone apps available on Google Play or Apple App Store are a typical example of extensively popular and in-demand software products. In our study, we take inspiration from the requirements prioritization domain to identify and transform the end-users' requirements present in reviews pertaining to an app into actionable knowledge for app developers. The generated actionable knowledge significantly assists the app developers towards the addressal of important end-users' requirements, which further leads towards the prolong sustainability of an app in the competitive smartphone app market. The contribution of this study is four folds; in the initial phase, we conducted a systematic map of the requirements prioritization domain which led towards the elicitation, classification, and prioritization phases of app-reviews. In the elicitation phase, we utilize a rule-based machine learning approach to identify reviews of an app that reflect end-users' requirements. Next, we classify

the extracted reviews using an automatically generated taxonomy using the concepts of contextual semantic similarity and Pareto distribution law. Finally, using a multi-criteria heuristic function, we prioritize the classified reviews to generate a comprehensive information that represents the actionable knowledge for app developers. Till date, we have empirically evaluated the elicitation and classification phases of this study, and currently, we are in the process of implementing the prioritization phase after which it will be subjected to suitable evaluation measures to assess its cogency. Furthermore, we plan to exhibit the application level functioning of elicitation, classification, and prioritization phases in the form of an online tool to demonstrate the proof of concept of the undertaken research study.

## **Exploring Various Nuances of Amazon Comments To Identify Patterns of Reviewers**

**Pradeesh Parameswaran, Andrew Trotman**

Given the rampant growth of e-commerce sites and not to mention the amount of product reviews that is being done, it is very important for the potential customers and people to know if the opinions are indeed genuine or if it is being sponsored by certain parties to artificially boost it. In this exploratory research we looked at Amazon's Dataset which contains slightly over 150 Million reviews across 47 categories. We then performed a sentiment analysis on the huge set of data to understand if the rating and the comments are correlated. The main challenge was on getting the ground truth as from our observations – the way how reviews are written varies by category. From our set of data, we have noticed that, it is still a challenge for sentiment analysis tool out there to pick up sarcasm. Finally, we also discuss some of the works that were done on past literature on fake reviews in other domains (i.e hotel/restaurants) and how it may be built on-top for e-commerce which has a variety different of domains.

## **The problem of collective action: Analysis using extensive form games**

**Abira Sengupta, Stephen Cranefield, Jeremy Pitt**

The problem of collective action is to understand how a group of self-interested agents can coordinate their action to achieve a common social goal. Social dilemmas arise in collective action when the members of the group are not trusting or cooperating with each other because there is a conflict between individual and collective interest so they behave in a non-cooperative or non-coordinating way. A number of social mechanisms have been proposed as explanations for successful collective action, such as promises, threats and psychological games. This presentation shows how extensive form game theory can be used to study collective action problems. An extensive form game is a model from game theory which clearly represents strategic aspects like players' possible moves, information about other players' move and the set of allowable actions at each decision point. My future aim is to build a simulation platform of agents who can make decisions about their action depending on

social expectations.

## Alignment Cascades in Collective Action

Ashal Srivathsan, Stephen Cranefield, Jeremy Pitt

The problem of collective action is to understand how people act together for the common good, on the basis of reasoning or good evidence. Information cascades can cause collective action to either succeed or fail dramatically. An information cascade occurs when an individual, having looked at the activities of those before him chooses to follow the majority behavior and discount his own information. For instance, people follow others and join for protest against the regime in order to achieve certain benefits. In many cases, cascades can be either positive in which all people adopt a socially beneficial behaviour or negative in which all people do the opposite. Our work introduces the problem, discusses some possible approaches and presents an initial information cascade simulation.

## Norm learning in multi-agent cooperative environments

Jithin Cherian, Tony Savarimuthu, Stephen Cranefield

Multi-agent environments are the replicates of real life scenarios. Modelling and establishing coordination to make multiple agents interact to achieve desired goals is still an exciting and challenging field of active research. Even though many are addressing coordination or competition among autonomous agents, norm establishment in Multi-Agent Systems still remains an open research domain which needs to be redressed effectively to bridge the gap between robots and human beings.

This research work aims to design and develop a novel framework for active norm learning in multi-agent cooperative environments using Multi-Agent Reinforcement Learning (MARL) and signalling or sanctioning mechanisms. In decentralised environments, the agents are driven by individual perceptions, which would ultimately decide the actual emergence of cooperation to achieve a common goal. However, if there emerge common norms for the participating agents to attain the ultimate aim, exciting outcomes can be expected in Human-Robot collaboration. This work targets to achieve such a norm learning system which could be passed to other agents also who were not part of the system when the norm had emerged. Moreover, if one intelligent agent can act altruistically to attain one common goal of a social system, it can even be used to teach the other agents to follow the same convention by means of agent communication.

## Optimising LoRaWAN for Internet of Things

James Walmsley, Haibo Zhang

LoRa and LoRaWAN are promising solutions for the upcoming challenges that the Internet of Things (IoTs) presents. But even with the recent developments in LoRaWAN, there are still problems to overcome due to the scale of applications required

for IoTs. LoRa and LoRaWAN provide many of the desired IoTs technology characteristics such as long range transmissions, low power use, and low device cost but have an issue with capacity. Building LoRaWAN networks with the capacity that the IoTs desires is the current challenge. I will primarily look at how LoRaWAN networks currently scale and how to optimise LoRaWAN deployments. LoRaWAN offers many avenues to optimise such as the programmable parameters of LoRa devices and their capability to form logical channels on one channel. LoRaWAN can also be optimised at the application side by introducing methods that make end-devices 'smarter' or try to leverage the global information that gateways can attain. Overall, utilising any of the optimisation avenues above could open LoRaWAN to many more applications and help with addressing the challenges of IoTs.

## **Roll of beam forming for future wireless communication systems**

**Waqas Ahmad, Haibo Zhang, Yawen Chen**

Today's mobile users demand for ultra-fast wireless Internet, reliability and uninterrupted services on the go. Future wireless communication system -5G-looks promising to fulfill such requirements and can do much more to bring new revolution in life of whole mankind. It is desirable that every user may be able to communicate with network over the wireless medium independently without affecting other user's communication. The Beamforming techniques can be considered as a bridge between mobile users and networks to avoid interference among users and transfer high-speed data streams in the form of beams by using antenna arrays. By increasing the number of antennas more beams can be transmitted simultaneously. The existing beamforming techniques suffer from hardware limitations and performance challenges due to the integration of large number of antennas in wireless devices, dynamic environment and gradually rising density of wireless devices. The problem will become more challenging and hard, as the number of connected smart wireless devices (autonomous cars, household appliances, etc.) will exponentially increase due to the rapid growth of technology.

## **New mechanisms are required in network layers to leverage 5G capacity**

**Mahdi Arghavani, Haibo Zhang, Zhiyi Huang**

Applications like autonomous driving, augmented reality, and virtual reality require end-to-end packet latencies in the 1-10ms range. They also require higher bandwidth than what has

been prepared by current wireless technologies. Large quantities of available spectrum at higher frequency ranges proposed fifth-generation (5G) wireless network as a first feasible option to address the diverse requirements of this broad set of new applications. But different characteristics of high frequency waves introduces new challenges like the variability of the wireless link bandwidth. This rapid change in throughput and intermittent disconnectivity because of obstacles can have negative

effects on ISO layers and degrade application performance. Bigger transport block in mac layer makes it possible to deliver more than one packet at each time slot that in turn imposes a burst of date delivery to the upper layers. New transport-layer mechanisms may also be required to utilize the large capacity, when available, and to react promptly to rapid fading to avoid congestion. It is also important to investigate new techniques in application layer to leverage 5G potential. For example, video adaptation techniques and streaming protocols should be implemented to select proper video coding rate that better matches the instantaneous network capacity.

## Is blockchain still secured in networks with high latency?

**Luming Wan, Haibo Zhang, Yawen Chen**

Blockchain technology first gained prominence due to interest and investment into bitcoin. Beyond the use for cryptocurrency, it is believed that blockchain can also be applied to emerging peer-to-peer decentralised applications running on vehicular ad hoc networks (VANET), sensor networks and so on. However, the emerging network applications might have comparatively higher latency than typical Internet communication, which in humanitarian crises decision-makers need information to guide them in making critical decisions. Finding information in such chaotic environments – where computing facilities are unreliable – is a challenging task. Therefore, decision-makers rely on domain experts who possess experience and knowledge from previous humanitarian crises to provide them with the information they need. In this research, we explore the ability of computing technologies to augment the capabilities of those experts and help decision-makers to make faster and better decisions. In this research we rely on three artificial intelligence technologies, namely: semantic web, machine learning, and natural language processing. We use these three technologies together to transform existing Voxels can be used as an alternative form of rendering and representation for mixed reality environments, but they are not genuinely supported by modern scenegraph implementations and game engines which are designed around the paradigm of meshes. We combine the best of both worlds and present our open source framework integrating a voxel-based approach into a game engine environment for capture, rendering, replay, and telepresence experiences of mixed reality scenes based on voxels. We describe the conceptual approach, architecture, and implementation to allow developers to rapidly build coherent voxel-based immersive mixed reality experiences. Information from human oriented into machine friendly format, develop solutions to interpret and parse them without human intervention, and allow decision makers to retrieve required information whenever they need to. This PhD research has been started two years ago and expected to take one more years to finish. Blockchain may degrade the security of decentralised consensus mechanisms. In this talk, I will introduce blockchain technology, also show whether the blockchain can still guarantee its security under networks with high latency.