Annexe 1

Distributed Data Usage Control for Physically Privacy-Tagged Pictures (Alexander Pretschner – Isao Echizen)

Background. NII is currently working on wearable tags that encode privacy policies. These policies stipulate requirements such as "do not archive, " "do not identify person," "do not publish," "do not search," "anonymize when publishing." If a picture of a person wearing such a tag is taken and the picture is to be published by a content provider, the policy is analyzed and enforced by this content provider. This requires trust in the content provider; if violations of a policy are detected, the content provider's trust ratings can be reduced. There are several requirements on the part of the photo that contains the tag: it should be robust to modifications so that even if the picture is processed, the tag (that is, the encoded policy) should still be recognizable in the modified picture.
TUM is currently working on distributed data usage control. Usage control policies ("don't print," "delete after thirty days," "don't distribute") are logically or physically stuck to data. Whenever data is passed from one system to another, the developed usage control enforcement infrastructure makes sure that the respective policy is sent along with the data. The recipient's usage control infrastructure then enforces the policy that was stuck to the data item. This requires the deployment of a usage control enforcement infrastructure on every possible recipient.
Gap. The work at NII focuses on wearable tags, extraction of policies from tags, and visual robustness of the tags. Enforcement of the respective policies is left to the content provider to which the data is uploaded. The work at TUM focuses on policy enforcement. The existence of data with attached usage control policies is assumed. TUM is missing a realistic input of data with policies that NII can provide. NII is missing an enforcement infrastructure that TUM can provide.
Aim of the cooperation. The goal of the intended cooperation is to close the gap by connecting the two approaches. NII will provide technology for identifying and interpreting policy tags. TUM will provide technology for enforcing distributed usage control requirements. In the end, there will be a system that, upon reception of a photo (identified by, e.g., magic numbers), will (1) extract the tag and the respective policy, (2) forward the data item and the identified policy to a distributed usage control infrastructure, and (3) make sure, by using the aforementioned usage control infrastructure, that the policy encoded in the tag is enforced in the relevant distributed system. In sum, the resulting system will make it possible to enforce usage control policies provided by photos that contain wearable privacy tags.

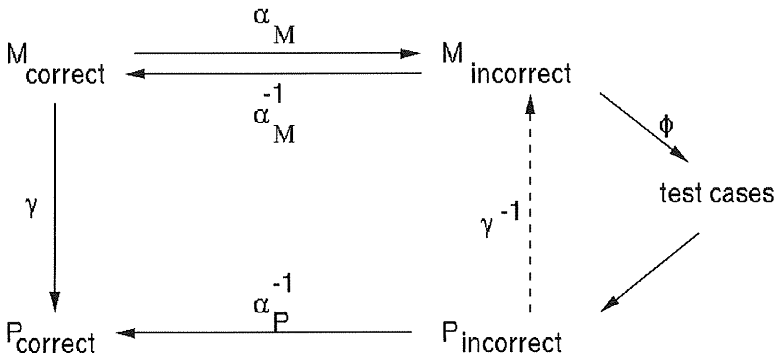
Annexe 2

Fault-Based Repair with Bidirectional Transformations (Alexander Pretschner- Zhenjiang Hu)

Background. NII is currently working on bidirectional model transformations. Under certain circumstances, if a unidirectional transformation is provided, NII technology can compute one candidate for the inverse transformation.
TUM is currently working on fault-based testing. Faults are described, among other things, as syntactic transformations – higher order mutation operators – of correct programs or models. For faults of a specific class, TUM technology can compute test cases that target the specific fault.

Gap and research question. Bidirectional transformations have been applied in a variety of contexts, but not for program repair. Fault-based testing has been used to identify faults in programs or models, but not for the inverse transformation, namely repairing programs. One open research question is whether bidirectional transformations can be used for automated program repair.

Aim of the cooperation. The goal of the intended cooperation is to answer the research question by developing technology that can repair programs or models on the grounds of existing descriptions of fault models. In a nutshell, the problem is the computation of a program transformation α_P^{-1} that takes an incorrect program containing a fault of a specific class, and yields a program that does not contain a fault of the specific class (Figure 1).



$$\text{Goal: compute } \alpha_P^{-1} = \gamma \circ \alpha_M^{-1} \circ \gamma^{-1}$$

Figure 1

Fault models are syntactic model transformations, α_M, with induced or explicit descriptions of failure domains, φ. TUM has worked on describing α_M and computing φ in various domains. γ describes the generation of code from models. NII has expertise in determining bidirectional transformations as function pairs γ and γ^{-1}. With testing based on fault models, one can potentially identify whether or not a program contains faults of a certain class, as defined by α. The idea is to find the inverse of a mapping that describes faults at the level of models, α_M^{-1}, and use it to derive a program correction α_P^{-1} on the grounds of the code generation/abstraction mapping γ and γ^{-1}, as described in Figure 1.

Annexe 3 "Immersive Communication" (Eckehard Steinbach- Gene Cheung)

Prof. Eckehard Steinbach of Munich University of Technology and Prof. Gene Cheung of National Institute of Informatics will collaborate on the topic of "immersive communication". Though advances in video coding & streaming mean video conferencing systems such as Skype are now commonplace, the quality of experience (QoE) is still less than desirable. In particular, the sense of co-presence of the participants or immersion into the same virtual environment is still quite far from inter-personal interaction in the physical world. In this research, we strive to overcome this experience gap through networked media interaction systems that focus on two of our innate human senses: visual and haptics. For visual interaction, we will study how 3D visual information can be captured, compactly represented and coded, so that at the decoder, a desired virtual image from an appropriate viewpoint (e.g., driven by the currently tracked observer's gaze and head location) can be synthesized and rendered in real-time on a large screen for visual realism. For haptics interaction, we will study how physical movement of one party can be captured non-intrusively, transmitted and expressed in an appropriate medium at the receiver's end, so that the resulting haptics interaction can enhance the sense of co-presence. What is most interesting is how interactions of the multiple media can be mixed for an enhanced experience; e.g., if an abnormal visual or audio event is detected at the sender (e.g., a suddenly raised voice), it can be expressed as an additional haptics event (e.g., vibration of a sitting chair) for an amplified effect. Research topics included in the collaboration include: networked visual communication systems, networked haptics interaction systems, mixed media mode immersive communication, joint gaze pattern analysis in collaborative environments, etc.

Annexe 4
Extracting semantic representations from human activities using virtual reality (Gordon Chengur – Tetsunari Inamura)

Virtual environments (VE) are human-computer interfaces in which the computer creates a sensory immersing environment that interactively responds to and is controlled by the behavior of the user. For example, SIGVerse is a simulator environment, which combines dynamics, perception, and communication simulations for synthetic approaches to research into the genesis of social intelligence. This simulator represents a very powerful tool especially when several activities are investigated such as cooking, cleaning, etc. because it provides different points of view of the executed task and all the devices are synchronized.

One of the main goals of such virtual simulators is to improve the human-robot interaction using different interfaces such as a head mounted display (HMD), human tracking devices (e.g. Kinect, Leap Motion, etc). Using those kind of simulators represent a big advantage because multiple users can join the experiment in a virtual environment through immersible VR interface from anywhere at any time. Then, the behavior used from the different users while performing a similar activity could be stored in a data base. After obtaining the data the next step is to understand the activities performed by humans, which represents a very interesting challenge. In order to do that, it is well known that one important source of information is through the environment because it contains the relationships between objects, actions, motions, places, etc. Those relationships are defined given the current context and can be modeled using semantic representations in order to understand and extract the meaning behind those complex activities into high-level reasoning.

Aim of the cooperation: The student/researcher at TUM will explore a variety of different tasks that can be benefit by being performed within a synthetic world. This means that the TUM group will develop new environments into the SIGVerse simulator in order to collect new data from different scenarios. Additionally, the TUM group will develop and evaluate different user interfaces such as Kinect2, HMD (Oculus Rift), leap motion, etc. Afterward, that data will be