Thesis Plan

for Bachelor Thesis

Alexey Tukalo,
EFA12SF,
Information Technology,
Savonia University of Applied Sciences

February 16, 2016

1 Introdaction

Volume rendering is a well known concept in computer graphics, the main theoretical base was developed at 80s and early 90s. Nowadays an ordinary work station gives as an opportunity to render an interactive volume scenes and as result the topic is experiencing a significant revival. The technology is used for visualisation of medical studies, scientific data collected by different types of sensors and physical models for particles, fluids and gases.

I made myself familiar with a concept of volume rendering during my internship at Karlsruhe Institute of Technology(KIT), there I worked on modification of Tomoraycaster 2 to give it an opportunity to render multimodal volume data.

I am going to implement an engine for a volume rendering in C# accelerated by DirectX, the engine will become a part of LightningChart. LightningChart is a proprietary library for visualisation of scientific data developed by Arction Oy. Arction wants to add volume rendering possibilities to their product, but an existing solution does not suit them well, because they need to have very deep integration with their current engine and they want to keep their source code as independent as it is possible.

2 Theoretical base

As I already noticed that, the theoretical base for the volume rendering was developed more than 20 years ago. The idea started from the rendering equation simultaneously derived by David Immel and James Kajiya in 1986.
There are four main volume rendering technique:

- Volume Ray Casting
- Splatting
- Shear warp
- Texture-based volume rendering

I am going to start the development from an implementation of the most basic Ray Casting algorithm. The Ray Casting also called image-ordered volume rendering. Basically, it shoots rays from every pixel in the screen and samples the data from the volume in according with so called ray function. A ray function is an equation which determines how the volume would be sampled.

The technique has two main advantages:

- Very high quality with very low amount of artifacts
- Number of various ray functions gives us an extra flexibility

But the Ray Casting has a very big disadvantages, it contains a lot of interpolations for calculations of values for rays' hit points, it makes the algorithm relatively slow.

So, I am going to speed the engine up by moving the implementation to the Shear Warp realisation. Basically the algorithm is an optimisation of the Ray Casting approach which is created to avoid any kind of calculations related with an interpolation at the sampling stage. It is realised by an additional preprocessing stage called Shear. The stage contributes some artifacts which are reduced at the last step of rendering called Warp. In other words, Shear-Warp is realisation of Volume Ray Casting with two additional pre and postprocessing steps.

3 Objectives and results

The final result of the project is realisation of an interactive volume rendering engine integrated into two versions of LightningChart(DX9 and DX11) which will became private property of Action Oy.

4 Implementation

The engine has to be integrated inside LightningChart, so in one hand it restricts me to use C#, HLSL and DirectX as my main tools. In the other hand I can get significant profit from the features already implemented inside the library, for example it will help me to implement rotation of the object, mouse interaction detection and so on.

I will be responsible for the development of the entire engine and visualisation based on the engine. The visualisation would be an example of the main possibilities which the engine will provide to the LightningChart. It will give us an opportunity to test and verify the software quality. The project will be implemented under mentoring of Mr. Pasi Tuominen[1], he will guide me in terms of source code organisation and evaluation of the final solution.

I broke the development to the several steps:

1. Create testing application with a cube which would represent the inner boundaries of the volume.
2. Implement the most basic shader and new type of objects which will be rendering with this shader.
3. Read the volume data as set of textures.
4. Preprocess the texture to fit the hardware.
5. Implement the most basic Volume Ray Casting.
6. Implement a mouse interactions with the volume.
7. Optimize the volume rendering:
   (a) Add Shear and Warp steps to the Ray Caster.
   (b) Add spatial structure optimization.
8. Implement rotation.
9. Implement lightning effects.
10. Port the solution to an other version of LightningChart.

5 Resources

All resources needed for the development are provided by Arction Oy:

- The workstation with Windows.
- Visual Studio and other software.
- Development version of LightningChart.

The main part of the work would be made by myself, so any addition human resources are not needed. In according with my calculations the project will take me from 240 to 360 hours, and it will cost Arction from 1500 to 2000 €.

6 Risk

The project has very low risks, because I am going to use well known techniques based on fundamental researches and my implementation is going to be made on the highly reliable technologies widely used in the market. The solution will become a part of the LightningChart to give current Arction's customers new possibilities and attract new ones interested in the feature.

The source code created during the project will become private property of Arction Oy.

[1] CEO of Arction Oy

7 Report documentation

Preliminary table of contents and a documentation plan of the final thesis:

1. Introduction to Volume Rendering
   - 1.1 Motivation
   - 1.2 Introduction to LightningChart
   - 1.3 Volume Rendering Algorithms
2. Implementation of the Volume Rendering
   - 2.1 Implementation of Volume Ray Casting
   - 2.2 Optimization of the engine
   - 2.3 Advantages of Shear Warp
3. Results
   - 3.1 Evaluation
   - 3.2 Discussion
   - 3.3 Conclusion
4. References

Arction does not request any additional reports. Results of the project will be presented to the University on the seminar presentation.

8 Bibliography

- Fast Volume Rendering Using a Shear-Warp Factorization of the Viewing Transformation by Philippe Lacroute(Computer System Laboratory Stanford University) and Marc Levoy(Computer Science Department Stanfrod University), for Computer Graphics Processings, Annual Conference Series, 1994
- Fast Volume Rendering Using A Shear-Warp Factorization of The Viewing Transformation by Philippe Lacroute(Computer System Laboratory Stanford University), September 19995
- Parallel Shear-Warp Factorization Volume Rendering Using Efficient 1-D and 2-D Partitioning Schemes for Distributed Memory Multicomputers by Ching-Feng Lin, Don-Lin Yang and Yeh-Ching Chung, Department of Information Engineering, Feng Chia University, Taiwan, 2002
- Advanced Illumination Techniques for GPU-Based Volume Raycasting by Markus Hadwiger, Patric Ljung, Christof Rezk Salama, Timo Ropinski
- GPU Gems, Chapter 39. Volume Rendering Techniques by Milan Ikits, Joe Kniss, Aaron Lefohn, Charles Hansen
- Volume Visualization and Volume Renderng Techniques by M. Meißner, H. Pfister, R. Westermann, C.M. Wittenbrink, EUROGRAPHICS 2000

9 Appendix

europass Curriculum vitae

PERSONAL INFORMATION

Alexey Tukalo

Taivaanpankontie 14 A 14/1, 70200 Kuopio (Finland)

+7(953)5441714

airtucha@icould.com

Skype AIRTucha

Sex Male | Date of birth 21/07/1994 | Nationality Russian

WORK EXPERIENCE

20/05/2013–20/06/2013

Intern Computer Support Specialist

LLC "Center of Information Technologies" All-In " trademark "Access Point", Belomorsk (Russia)

07/07/2015–18/10/2015

Image processing

Karlsruhe Institute of Technology, Karlsruhe (Germany)

- Development of combined 3D USCT volume data visualization on Java(ImageJ) and MATLAB
- Development of prototypes for 4D information visualization
- Implementation of the data visualization in our customized DICOM viewer including the data handling and user interface design.
- WebGL visualisation of 3D volums

Related document(s): KIT.pdf

01/05/2015–31/10/2015

Team Leader

Pricelizer, Inc., Stockholm (Sweden)

- Management of teams distributed around the world
- Work experience in start-up
- Remote work
- Management of it projects

Related document(s): Pricelizer.pdf

01/12/2015–Present

Data Visualization with C#

Arction Oy, Kuopio (Finland)

- LigthningChart related software development
- Customer projects programming
- Testing
- Quality control

EDUCATION AND TRAINING

16/01/2015–31/05/2015

Institute of Technologies Tralee, Tralee, Éire/Ireland

Erasmus+ Program Exchange

- Project Management,
- System Architecture,
- Game Mechanics (Game Development with Unity and C#)

- Big Data
- Visual Communication

Related document(s): Tralee Transcript.pdf

03/09/2012–Present

BEng in Information Technologies

EQF level 6

Savonia University of Applied Sciences, Kuopio (Finland)

- Web and Mobile Development
- Embedded Systems
- Databases
- Object-orientated programming
- Computer Networks
- Digital-signal processing
- Control Engenering

Related document(s): Savonia Transcript.pdf , Karelia Transcript.pdf

01/09/2001–27/06/2012

Secondary Comprehensive School number 3, Belomorsk (Russia)

01/09/2003–16/01/2009

School of The Art, Belomorsk (Russia)

- Drawing
- Painting
- Sculpture
- History of Art
- Composition.

PERSONAL SKILLS

Mother tongue(s): Russian

Other language(s)

	UNDERSTANDING		SPEAKING		WRITING
	Listening	Reading	Spoken interaction	Spoken production	
English	C1	C1	B2	B2	B2

Levels: A1 and A2: Basic user - B1 and B2: Independent user - C1 and C2: Proficient user
Common European Framework of Reference for Languages

Communication skills

- To be honest, I am not extremely communicative, but I always like to meet new people and new teams.
- During the travels related to my studying, I gained a lot of experience in multicultural communication.
- Due to very good analytical skills, I am able to make very quick and accurate evaluation of a new person's abilities and so on.

Organisational / managerial skills

I fond of well organised work and I can take responsibility to organise my own work and the work of my teammates. But I would prefer to avoid any kind of conflicts with current team leader and chiefs.

Job-related skills

Java, C#, Java, C++, C, JavaScript(D3.js, WebGL, Node.js, ReactJS), Image Processing, MatLab, R, SQL, MongoDB.

Digital competence

SELF-ASSESSMENT				
Information processing	Communication	Content creation	Safety	Problem solving
Proficient user	Proficient user	Proficient user	Independent user	Proficient user

Digital competences - Self-assessment grid

Office applications, LaTex, Adobe Photoshop, Adobe Illustrator, Adobe Lightroom, Unity3D, PostgreSQL Server, Microsoft SQL Server, work with MS-Windows, OS X and Debian Linux.

Other skills

Raster graphics, colour correction, vector graphics, colour theory, composition, photography.

Driving licence

A, B

ANNEXES

- Pricelizer.pdf
- KIT.pdf
- Savonia Transcript.pdf
- Karelia Transcript.pdf
- Tralee Transcript.pdf

Alexey Tukalo

Mother tongue(s)	Other language(s)
Russian	English

English

Self-assessment of language skills

UNDERSTANDING		SPEAKING		WRITING
Listening	Reading	Spoken interaction	Spoken production	Writing
C1 Proficient user	C1 Proficient user	B2 Independent user	B2 Independent user	B2 Independent user

Certificates and diplomas

Title	Awarding body	Date	Level*
–	–	–	–

Linguistic and intercultural experience

Description	Duration
Using languages for study or training: Almost graduated Bachelor degree program in field of Information Technology with instruction in English at Savonia UAS.	3/9/12–Present
Using languages for study or training: One semester exchange studying in Ireland at Tralee Institute of Technology	18/1/15–24/5/15
Using languages at work: Internship at Karlsruhe Institute of Technology	7/7/15–18/10/15
Using languages at work: Internship at Pricelizer as a part of distributed team	1/5/15–31/10/15

* Indicate level of the Common European Framework of Reference (CEFR) if specified on certificate or diploma.

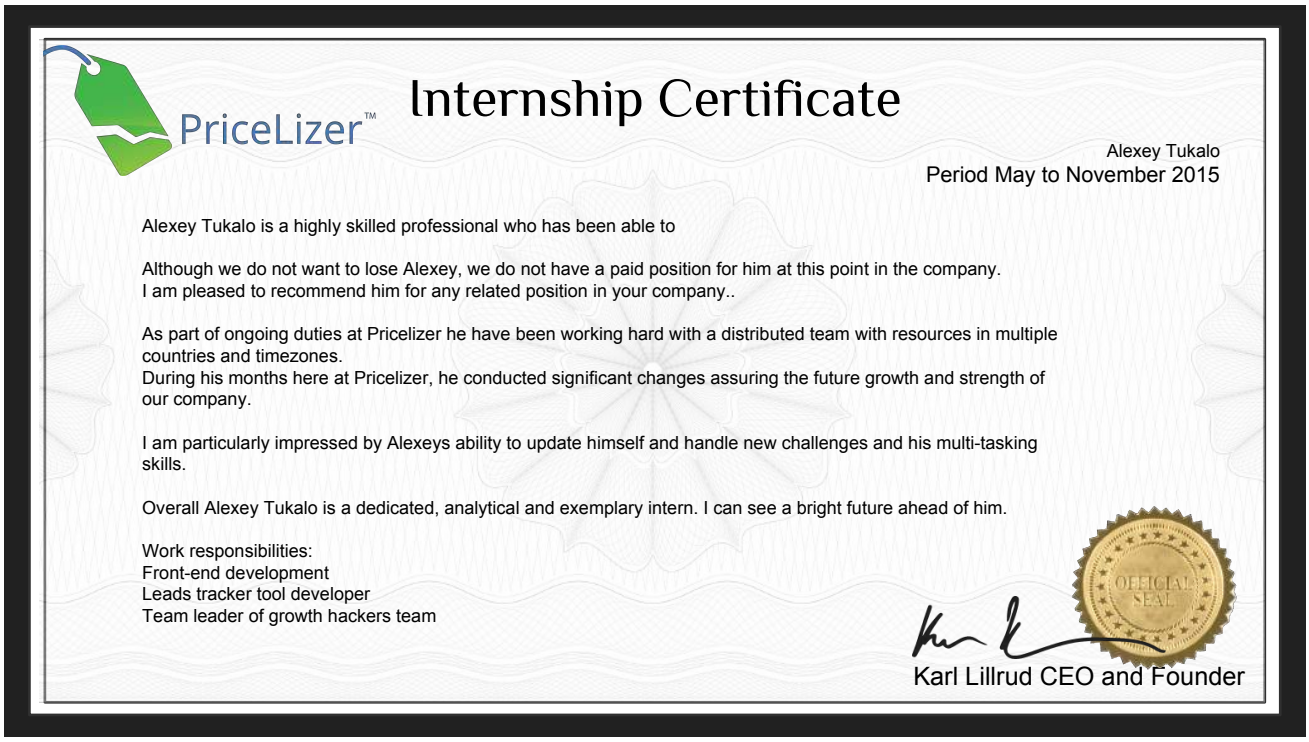
The Europass Language Passport is part of the European Language Portfolio developed by the Council of Europe (www.coe.int/portfolio).

Common European Framework of Reference for Languages - Self-assessment grid

		A1 Basic User	A2 Basic User	B1 Independent user	B2 Independent user	C1 Proficient user	C2 Proficient user
Understanding	Listening	I can understand familiar words and very basic phrases concerning myself, my family and immediate concrete surroundings when people speak slowly and clearly.	I can understand phrases and the highest frequency vocabulary related to areas of most immediate personal relevance (e.g. very basic personal and family information, shopping, local area, employment). I can catch the main point in short, clear, simple messages and announcements.	I can understand the main points of clear standard speech on familiar matters regularly encountered in work, school, leisure, etc. I can understand the main point of many radio or TV programmes on current affairs or topics of personal or professional interest when the delivery is relatively slow and clear.	I can understand extended speech and lectures and follow even complex lines of argument provided the topic is reasonably familiar. I can understand most TV news and current affairs programmes. I can understand the majority of films in standard dialect.	I can understand extended speech even when it is not clearly structured and when relationships are only implied and not signalled explicitly. I can understand television programmes and films without too much effort.	I have no difficulty in understanding any kind of spoken language, whether live or broadcast, even when delivered at fast native speed, provided I have some time to get familiar with the accent.
	Reading	I can understand familiar names, words and very simple sentences, for example on notices and posters or in catalogues.	I can read very short, simple texts. I can find specific, predictable information in simple everyday material such as advertisements, prospectuses, menus and timetables and I can understand short simple personal letters.	I can understand texts that consist mainly of high frequency everyday or job-related language. I can understand the description of events, feelings and wishes in personal letters.	I can read articles and reports concerned with contemporary problems in which the writers adopt particular attitudes or viewpoints. I can understand contemporary literary prose.	I can understand long and complex factual and literary texts, appreciating distinctions of style. I can understand specialised articles and longer technical instructions, even when they do not relate to my field.	I can read with ease virtually all forms of the written language, including abstract, structurally or linguistically complex texts such as manuals, specialised articles and literary works.
Speaking	Spoken interaction]	I can interact in a simple way provided the other person is prepared to repeat or rephrase things at a slower rate of speech and help me formulate what I'm trying to say. I can ask and answer simple questions in areas of immediate need or on very familiar topics.	I can communicate in simple and routine tasks requiring a simple and direct exchange of information on familiar topics and activities. I can handle very short social exchanges, even though I can't usually understand enough to keep the conversation going myself.	I can deal with most situations likely to arise whilst travelling in an area where the language is spoken. I can enter unprepared into conversation on topics that are familiar, of personal interest or pertinent to everyday life (e.g. family, hobbies, work, travel and current events).	I can interact with a degree of fluency and spontaneity that makes regular interaction with native speakers quite possible. I can take an active part in discussion in familiar contexts, accounting for and sustaining my views.	I can express myself fluently and spontaneously without much obvious searching for expressions. I can use language flexibly and effectively for social and professional purposes. I can formulate ideas and opinions with precision and relate my contribution skilfully to those of other speakers.	I can take part effortlessly in any conversation or discussion and have a good familiarity with idiomatic expressions and colloquialisms. I can express myself fluently and convey finer shades of meaning precisely. If I do have a problem I can backtrack and restructure around the difficulty so smoothly that other people are hardly aware of it.
	Spoken production	I can use simple phrases and sentences to describe where I live and people I know.	I can use a series of phrases and sentences to describe in simple terms my family and other people, living conditions, my educational background and my present or most recent job.	I can connect phrases in a simple way in order to describe experiences and events, my dreams, hopes and ambitions. I can briefly give reasons and explanations for opinions and plans. I can narrate a story or relate the plot of a book or film and describe my reactions.	I can present clear, detailed descriptions on a wide range of subjects related to my field of interest. I can explain a viewpoint on a topical issue giving the advantages and disadvantages of various options.	I can present clear, detailed descriptions of complex subjects integrating sub-themes, developing particular points and rounding off with an appropriate conclusion.	I can present a clear, smoothly-flowing description or argument in a style appropriate to the context and with an effective logical structure which helps the recipient to notice and remember significant points.
Writing	Writing	I can write a short, simple postcard, for example sending holiday greetings. I can fill in forms with personal details, for example entering my name, nationality and address on a hotel registration form.	I can write short, simple notes and messages. I can write a very simple personal letter, for example thanking someone for something.	I can write simple connected text on topics which are familiar or of personal interest. I can write personal letters describing experiences and impressions.	I can write clear, detailed text on a wide range of subjects related to my interests. I can write an essay or report, passing on information or giving reasons in support of or against a particular point of view. I can write letters highlighting the personal significance of events and experiences.	I can express myself in clear, well-structured text, expressing points of view at some length. I can write about complex subjects in a letter, an essay or a report, underlining what I consider to be the salient issues. I can select a style appropriate to the reader in mind.	I can write clear, smoothly-flowing text in an appropriate style. I can write complex letters, reports or articles which present a case with an effective logical structure which helps the recipient to notice and remember significant points. I can write summaries and reviews of professional or literary works.

Common European Framework of Reference for Languages (CEF): © Council of Europe

Pricelizer.pdf



PriceLizer™

Internship Certificate

Alexey Tukalo
Period May to November 2015

Alexey Tukalo is a highly skilled professional who has been able to

Although we do not want to lose Alexey, we do not have a paid position for him at this point in the company.
I am pleased to recommend him for any related position in your company..

As part of ongoing duties at Pricelizer he have been working hard with a distributed team with resources in multiple countries and timezones.
During his months here at Pricelizer, he conducted significant changes assuring the future growth and strength of our company.

I am particularly impressed by Alexeys ability to update himself and handle new challenges and his multi-tasking skills.

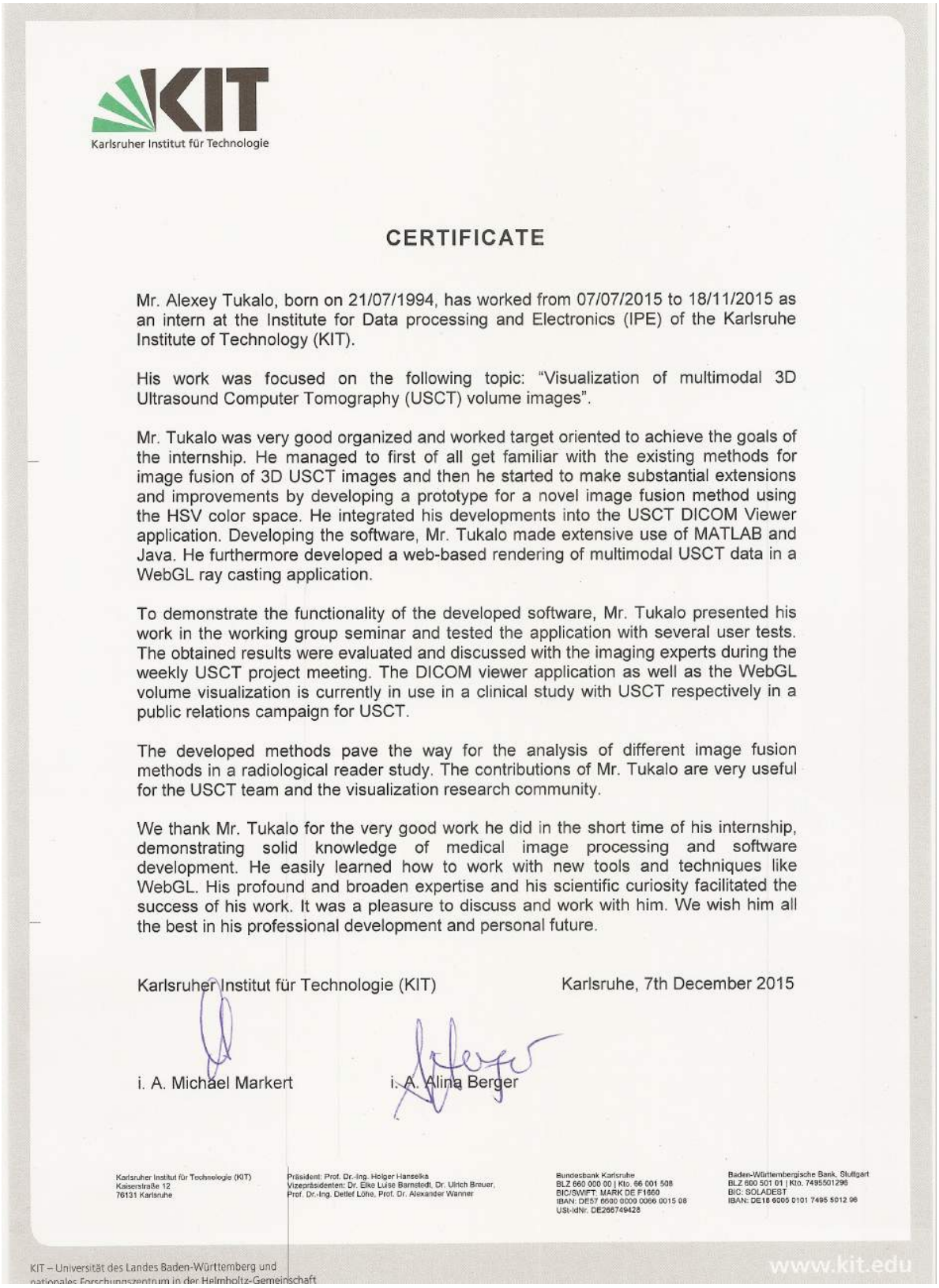
Overall Alexey Tukalo is a dedicated, analytical and exemplary intern. I can see a bright future ahead of him.

Work responsibilities:
Front-end development
Leads tracker tool developer
Team leader of growth hackers team

OFFICIAL SEAL

Karl Lillrud CEO and Founder

KIT.pdf



Karlsruher Institut für Technologie

CERTIFICATE

Mr. Alexey Tukalo, born on 21/07/1994, has worked from 07/07/2015 to 18/11/2015 as an intern at the Institute for Data processing and Electronics (IPE) of the Karlsruhe Institute of Technology (KIT).

His work was focused on the following topic: "Visualization of multimodal 3D Ultrasound Computer Tomography (USCT) volume images".

Mr. Tukalo was very good organized and worked target oriented to achieve the goals of the internship. He managed to first of all get familiar with the existing methods for image fusion of 3D USCT images and then he started to make substantial extensions and improvements by developing a prototype for a novel image fusion method using the HSV color space. He integrated his developments into the USCT DICOM Viewer application. Developing the software, Mr. Tukalo made extensive use of MATLAB and Java. He furthermore developed a web-based rendering of multimodal USCT data in a WebGL ray casting application.

To demonstrate the functionality of the developed software, Mr. Tukalo presented his work in the working group seminar and tested the application with several user tests. The obtained results were evaluated and discussed with the imaging experts during the weekly USCT project meeting. The DICOM viewer application as well as the WebGL volume visualization is currently in use in a clinical study with USCT respectively in a public relations campaign for USCT.

The developed methods pave the way for the analysis of different image fusion methods in a radiological reader study. The contributions of Mr. Tukalo are very useful for the USCT team and the visualization research community.

We thank Mr. Tukalo for the very good work he did in the short time of his internship, demonstrating solid knowledge of medical image processing and software development. He easily learned how to work with new tools and techniques like WebGL. His profound and broaden expertise and his scientific curiosity facilitated the success of his work. It was a pleasure to discuss and work with him. We wish him all the best in his professional development and personal future.

Karlsruher Institut für Technologie (KIT) Karlsruhe, 7th December 2015

i. A. Michael Markert i. A. Alina Berger

Karlsruher Institut für Technologie (KIT)
Kaiserstraße 12
76131 Karlsruhe

Präsident: Prof. Dr.-Ing. Holger Hanselka
Vizepräsidenten: Dr. Eike Lüse Barnekoldt, Dr. Ulrich Breuer,
Prof. Dr.-Ing. Detlef Löhe, Prof. Dr. Alexander Wanner

Bundesbank Karlsruhe
BLZ 660 000 00 | Kto. 66 001 508
BIC/SWIFT: MARK DE F1660
IBAN: DE57 6600 0000 0066 0015 08
USt-IdNr. DE266749428

Baden-Württembergische Bank, Stuttgart
BLZ 600 501 01 | Kto. 7495501296
BIC: SOLADEST
IBAN: DE18 6005 0101 7495 5012 96

KIT – Universität des Landes Baden-Württemberg und
nationales Forschungszentrum in der Helmholtz-Gemeinschaft

www.kit.edu

Savonia Transcript.pdf

Tukalo Alexey (21.07.1994)

School	Savonia UAS School of Engineering and Technology Kuopio
Degree	Bachelor of Engineering
Degree programme	Degree Programme in Information Technology
Date of enrollment	03.09.2012
Language of instruction	English

BASIC STUDIES

Communication Skills	3 cr	3	06.05.2014
English for Information Technology	3 cr	3	01.02.2013
Mathematical Tools	3 cr	5	20.12.2012
Differential Calculus	5 cr	5	27.09.2013
Integration and Differential Equations	3 cr	1	19.12.2013
Statistics	3 cr	4	26.09.2014
Mechanics (Physics 1)	3 cr	5	30.03.2013
Electricity (Physics 2)	4 cr	2	04.04.2014
Experimental Natural Science	3 cr	4	18.12.2013
Laboratory Work in Physics	3 cr	S	07.06.2014

COMMON PROFESSIONAL COURSES

Electrical Measurements	2 cr	5	29.12.2013
Personal Computing	2 cr	5	22.10.2012
Profitability and Investments	3 cr	2	16.12.2015
Introduction to Business Processes	5 cr	5	19.12.2014

SPECIALISED PROFESSIONAL STUDIES IN INFORMATION TECHNOLOGY

Electrical Circuit Analysis	2 cr	4	06.05.2013
Basics of Programming	9 cr	5	02.06.2013
Object Oriented Programming JAVA	7 cr	5	09.04.2014
Algorithms and Data Structures	3 cr	5	09.12.2013
Browser Programming	3 cr	5	17.05.2013
Data Management and SQL	4 cr	5	28.02.2014
Analog Electronics	4 cr	4	11.04.2014
Digital Electronics	5 cr	4	07.06.2014
Laboratory Work in Electronics	3 cr	4	07.06.2014
Basics of Computer Technology	4 cr	5	27.05.2013
Basics of Microprocessor Programming	3 cr	4	17.05.2013
Telecommunications Engineering	4 cr	4	07.06.2014
Computer Networks (CCNA 1)	3 cr	4	28.12.2012
Digital Signal Processing	4 cr	4	19.12.2014
Control Engineering	4 cr	4	19.12.2014
Basics of Microprocessor Technology	4 cr	4	19.12.2014
Laboratory Work in Telecommunications	6 cr	4	31.05.2015

ADVANCED PROFESSIONAL STUDIES IN TELECOMMUNICATIONS ENGINEERING

Healthcare Technology	3 cr	3	19.12.2012
Basics of Sensor Technology	3 cr	2	07.06.2014
C++ Programming	2 cr	5	07.06.2014
ICT Services and RDI	3 cr	4	18.12.2015
Microsensors and Mechanics	3 cr	4	17.12.2014
Wireless Technologies	3 cr	3	19.12.2014
Database Servers	3 cr	5	16.01.2015
Mobile Programming 1)	5 cr	4	19.12.2013
Project	3 cr	4	18.12.2015

Tukalo Alexey (21.07.1994)

Compensated Professional Studies 2)	25 cr	H	04.06.2015
PRACTICAL TRAINING			
Practical Training 1	6 cr	S	26.09.2013
Practical Training 2	12 cr	S	17.12.2015
Practical Training 3	12 cr	S	17.12.2015
OPTIONAL STUDIES			
Survival Finnish	2 cr	S	25.10.2012
Finnish for Foreigners 1	2 cr	1	12.12.2012
Orientation to the Higher Education Studies	1 cr	S	20.12.2012
Linux Operating System	2 cr	3	26.02.2013
Elementary mathematics	3 cr	5	22.03.2013
Cisco CCNA 2	3 cr	5	19.12.2013
Compensated Elective Studies 1)	4 cr	4	19.12.2013

Degree studies 217 credits.

Certified by
Kuopio 12.01.2016

Seija Jantti
Student Advisor

Grading Scale

Excellent (5), very good (4), good (3), satisfactory (2), sufficient (1), fail (0), pass (S), credits accepted as part of the degree (H). The grading scale for the other national language is good (4-5) and satisfactory (1-3).

Compensating studies

1) Karelia Open UAS 2013-2014
2) TRALEE Institute of Technology 2015

Karelia Transcript.pdf

Karelia-ammattikorkeakoulu **Opintosuoritusote** 1

Tikkarinne 9
80200 JOENSUU 10.09.2014

Opiskelija **Alexey Tukalo** MUU599AK14 **01.08.2013 - 31.07.2014**
1301633 210794-291U

Ohjelma **Muu ammattikorkeakoulutus, tekniikka** **9,00 op**
Suunta **Avoimen ammattikorkeakoulun opinnot**
Suoritettu **9,00 op**

Opinnot	Laajuus	Arv	Pvm	Opettaja
Artifical Intelligence in Games	4,00 op	4	19.12.2013	Nevalainen Seppo
Android Mobile Programming	5,00 op	4	12.08.2014	Nevalainen Seppo

Opinnot ovat Karelia-ammattikorkeakoulun tutkintovaatimusten mukaisia.

Joensuussa 10. syyskuuta 2014

Suvi Pajarinen
opintosihteeri

AMMATTIKORKEAKOULU · UNIVERSITY OF APPLIED SCIENCES · Karelia

5 = Kiitettävä 4 = Hyvä 3 = Hyvä 2 = Tyydyttävä
1 = Tyydyttävä 0 = Hylätty H = Hyväksytty X = Arviointi puuttuu

Tralee Transcript.pdf

INSTITUTE OF TECHNOLOGY
TRALEE
INSTITIÚID TEICNEOLAÍOCHTA TRÁ LÍ
OFFICE OF THE REGISTRAR - EXAMINATIONS

Fax: 066 7126711,
Telephone: 066-7145640
Website: www.ittralee.ie

T00185074

Alexey Tukalo
Taivaanpankonie 14 A 14/1
70200 Kuopio
Finland

Date: 18th June 2015
Programme Code: TL_XERAS_X
Term Code: 201400
Class Code: Y3

Statement of Provisional Examination Results

Dear Alexey

Following consideration of your performance in the recently held examinations in:

Programme Title: ERASMUS Students taking Mixed Courses

AY 2014/2015

The Examination Board has recommended as follows:

Individual Subject Results

Stage: 3

Sitting	CRN	Course Code	Course	Credits	Result
FSS	44847	COMP 81003	System Architecture	5	61
FSS	46319	DBMS 81000	Big Data	5	63
FSS	44889	MGMT 71003	Computer Services Management	5	67
FSS	48409	OFFS 61002	Visual Communication	5	78
FSS	47375	SWDV 61018	Games Mechanics	5	99

Stage Passed	Stage Credits Earned	Stage Credits Required	Stage %
N	25	200	73.6

Overall Result: Noted - Not Eligible for Award

You have passed the modules listed above.

Results subject to ratification by the Academic Council of IT, Tralee

Registrar

Page : 1 of 1