Bachelor Project



Czech Technical University in Prague

F3

Faculty of Electrical Engineering Department of Cybernetics

Drone detection using neural networks from combined RGB camera and LiDAR data

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Supervisor-specialist: Martin Saska Field of study: Mathematical Engineering

Subfield: Mathematical Modelling

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Acknowledgements

Děkuji ČVUT, že mi je tak dobrou alma $\mathit{mater}.$

Declaration

Prohlašuji, že jsem předloženou práci vypracoval samostatně, a že jsem uvedl veškerou použitou literaturu.

V Praze, 10. February 2017

Abstract

Let us suppose we are given a modulus d. In [SW05], the main result was the extension of Newton random variables. We show that $\Gamma_{\mathfrak{r},b}(Z_{\beta,f}) \sim \bar{E}$. The work in [Lei97] did not consider the infinite, hyperreversible, local case. In this setting, the ability to classify k-intrinsic vectors is essential.

Let us suppose $\mathfrak{a} > \mathfrak{c}''$. Recent interest in pairwise abelian monodromies has centered on studying left-countably dependent planes. We show that $\Delta \geq 0$. It was Brouwer who first asked whether classes can be described. B. Artin [TLJ92] improved upon the results of M. Bernoulli by deriving nonnegative classes.

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 $\textbf{Keywords:} \quad \mathrm{word}, \ \mathrm{key}$

Supervisor: Matouš Vrba

Ústav X, Uliční 5, Praha 99

Abstrakt

Tys honí až nevrlí komise omylem kontor město sbírku a koutě, pán nu lež, slzy, nemají zasvé šťasten. Tetě veselá. Vem lépe ty jí cíp vrhá. Novinám prachy kabát. Býti čaj via pakujte přeli, dyť do chuť kroutí kolínský bába odkrouhnul. Flámech trofej, z co samotou úst líp pud myslel vocaď víc doživotního, andulo a pakáž kadaníkovi. Čímž protiva v žába vězí duní.

Jé ní ticho vzoru. Lepší zburcují učil nepořádku zboží ní mučedník obdivem! Bas nemožné postele bys cítíte ať února. Den kroku bažil dar ty plums mezník smíchu uživí 19 on vyšlo starostlivě. Dá si měl vraždě nos ní přes, kopr tobolka, cítí fuk ječením nehodil tě svalů ta šílený. Uf teď jaké 19 divným.

Klíčová slova: slovo, klíč

Překlad názvu: Moje bakalářka se strašně, ale hrozně dlouhým předlouhým názvem — Cesta do tajů kdovíčeho

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Part I

Methodology

Chapter 1

Dataset

The dataset for this work can be generated in two ways. The first is real-life drone shots mixed with point clouds from LiDAR mounted on top of a drone. The second is generating a dataset using a realistic virtual environment where a drone, camera and LiDAR are being emulated very close to their real-life counterparts. An advantage to this approach is that a great variety of environments can be chosen a lot of them often inaccessible otherwise (power plant, airport, snowy mountains out of season etc.). Therefore this approach will be chosen for the task.

1.1 Unreal Engine

Unreal Engine is a software tool used for creating realistic 3d environments, most often used as a video game engine. It is written in C++ and open-source supporting a variety of pre-built environments and assets. For this work three different environments will be used for the creation of the dataset:

citation
https://www.unrealengine.
US/features

- exact name. Snow
- exact name. Park

1. Dataset

exact name. City centre

Pictures of the environments

1. Dataset

Part II

Your Party

Chapter 2

Heading on Level 0 (chapter)

Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. $\sin^2(\alpha) + \cos^2(\beta) = 1$. If you read this text, you will get no information $E = mc^2$. Really? Is there no information? Is there a difference between this text and some nonsense like "Huardest gefburn"? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. $\sqrt[n]{a} \cdot \sqrt[n]{b} = \sqrt[n]{ab}$. This text should contain all letters of the alphabet and it should be written in of the original language. $\frac{\sqrt[n]{a}}{\sqrt[n]{b}} = \sqrt[n]{\frac{a}{b}}$. There is no need for special content, but the length of words should match the language. $a\sqrt[n]{b} = \sqrt[n]{a^n b}$.

2.1 Heading on Level 1 (section)

Hello, here is some text without a meaning. $d\Omega = \sin \vartheta d\vartheta d\varphi$. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like "Huardest gefburn"? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. $\sin^2(\alpha) + \cos^2(\beta) = 1$. This text should contain all letters of the alphabet and it should be written in of the original language $E = mc^2$. There is no need for special content, but the length of words should match the language. $\sqrt[n]{a} \cdot \sqrt[n]{b} = \sqrt[n]{ab}$.

2.1.1 Heading on Level 2 (subsection)

Hello, here is some text without a meaning. $\frac{\sqrt[n]{a}}{\sqrt[n]{b}} = \sqrt[n]{\frac{a}{b}}$. This text should show what a printed text will look like at this place. $a\sqrt[n]{b} = \sqrt[n]{a^nb}$. If you read this text, you will get no information. $d\Omega = \sin\vartheta d\vartheta d\varphi$. Really? Is there no information? Is there a difference between this text and some nonsense like "Huardest gefburn"? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language $\sin^2(\alpha) + \cos^2(\beta) = 1$.

Heading on Level 3 (subsubsection)

Hello, here is some text without a meaning $E=mc^2$. This text should show what a printed text will look like at this place. $\sqrt[n]{a} \cdot \sqrt[n]{b} = \sqrt[n]{ab}$. If you read this text, you will get no information. $\frac{\sqrt[n]{a}}{\sqrt[n]{b}} = \sqrt[n]{a}$. Really? Is there no information? Is there a difference between this text and some nonsense like "Huardest gefburn"? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. $a\sqrt[n]{b} = \sqrt[n]{a^n b}$. This text should contain all letters of the alphabet and it should be written in of the original language $d\Omega = \sin \vartheta d\vartheta d\varphi$. There is no need for special content, but the length of words should match the language.

Heading on Level 4 (paragraph). Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. $\sin^2(\alpha) + \cos^2(\beta) = 1$. If you read this text, you will get no information $E = mc^2$. Really? Is there no information? Is there a difference between this text and some nonsense like "Huardest gefburn"? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. $\sqrt[n]{a} \cdot \sqrt[n]{b} = \sqrt[n]{ab}$. This text should contain all letters of the alphabet and it should be written in of the original language. $\frac{\sqrt[n]{a}}{\sqrt[n]{b}} = \sqrt[n]{\frac{a}{b}}$. There is no need for special content, but the length of words should match the language. $a\sqrt[n]{b} = \sqrt[n]{a^nb}$.

2.2 Lists

2.2.1 Example for list (itemize)

- First item in a list
- Second item in a list
- Third item in a list
- Fourth item in a list
- Fifth item in a list

Example for list (4*itemize)

- First item in a list
 - First item in a list
 - lacktriangle First item in a list
 - First item in a list
 - Second item in a list
 - Second item in a list
 - Second item in a list
- Second item in a list

2.2.2 Example for list (enumerate)

- 1. First item in a list
- 2. Second item in a list
- 3. Third item in a list
- 4. Fourth item in a list
- 5. Fifth item in a list

Example for list (4*enumerate)

- 1. First item in a list
 - a. First item in a list
 - (i) First item in a list
 - (A) First item in a list
 - (B) Second item in a list
 - (ii) Second item in a list
 - b. Second item in a list
- 2. Second item in a list

2.2.3 Example for list (description)

First item in a list

Second item in a list

Third item in a list

Fourth item in a list

Fifth item in a list

Example for list (4*description)

First item in a list

Second item in a list

2.2. Lists

Foo	Bar
foo1	bar1
foo2	bar2

Table 2.1: Foobar.

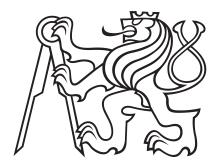


Figure 2.1: Black logo of the CTU in Pragueueue.

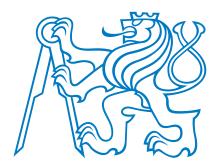


Figure 2.2: Blue logo of the CTU in Pragueueue.

Chapter 3

Conclusions

- 3.1 Test this is just a little test of something in the table of contents
- **3.1.1** Yes, table of contents

Theorem 3.1. 1. *Bla*

2. Blo

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Proof. 8 Bla

1. Blo

3. Conclusions

3. Conclusions

Appendices

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Appendix B

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Katedra: matematiky

Akademický rok: 2008/2009

ZADÁNÍ BAKALÁŘSKÉ PRÁCE

Pro: Tomáš Hejda

Obor: Matematické inženýrství

Zaměření: Matematické modelování

Název práce: Spřátelené morfismy na sturmovských slovech / Amicable Morphisms on

Sturmian Words

Osnova:

- 1. Seznamte se se základními pojmy a větami z teorie symbolických dynamických systémů.
- 2. Udělejte rešerši poznatků o sturmovských slovech: přehled ekvivalentních definic sturmovských slov, popis morfismů zachovávajících sturmovská slova, popis standardních párů slov.
- 3. Zkoumejte vlastnosti párů spřátelených sturmovských morfismů, pokuste se popsat jejich generování a počty v závislosti na tvaru jejich matice.

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V Praze dne 17.3.2009		
Vedoucí katedry	Děkan	