

Dokumentation

TSP – ANT – Programm

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Abstract—Im Verlauf des Moduls “Fachübergreifendes Labor”, wurde ein Projekt ausgerollt, um die Entwicklung einer Software mit Hilfe agiler Techniken und derer Methoden zu erlernen.

Dabei wurde der Schwerpunkt auf die Technik des Extreme Programming (XP) und dessen Inhalte (Stand-Up Meeting, Story-Cards, Pair-Programming) gelegt.

Der Inhalt des Projektes befasst sich mit dem Lösen verschiedener Travelling Salesman Probleme (TSP) mit Hilfe des sogenannten Ameisenalgorithmus. Dieser beschreibt die optimale Wegfindungsstrategie für zwischen beliebigen Zielen. Dabei wandern alle Ameisen alle möglichen Verbindungswege ab und markieren durch ihre Hormone die kürzeste Rundreise aller Ziele.

EINLEITUNG

TSP

Das TSP Problem (Travelling Salesman Problem), auf Deutsch „Problem des Handlungsreisenden“ genannt, ist ein kombinatorisches Optimierungsproblem. Dabei wird die kürzeste Strecke aller Orte x gesucht, wo jeder dieser Orte nur einmal angesteuert werden darf. Der Start-Ort ist dabei auch der End-Ort. Die optimale Lösung soll dabei die kürzestmögliche Länge der Rundreise aller vorhandenen Städte x ergeben. Die Problematik besteht dabei in der exponentiell

steigender Anzahl der Strecken und somit der Rechenzeit zur Anzahl der Orte x . Die Anzahl aller Möglichkeiten lässt sich mit $x!$ (x Fakultät) berechnen. Als Beispiel wären es bei 10 Städten ($x=10$)

$10*9*8*7*6*5*4*3*2*1=3.628.800$ mögliche Rundreisen.

Die Optimierung dabei ist das Ziel die bestmögliche aller vorhandenen Rundreisen zu finden. Da man zeitlich nicht alle möglichen Routen untersuchen kann, werden Optimierungsalgorithmen wie der Ameisenalgorithmus (ACO) verwendet, damit in absehbarer Zeit eine relativ beste Lösung gefunden werden kann und die Berechnung der Suche der optimalen Route nicht in makroskopische Dimensionen anwächst.

Dennoch garantiert das optimierte Ergebnis nicht das Finden der besten Route; dies kann nur durch die Untersuchung aller möglichen Routen gewährleistet werden.

ACO

Der ACO (Ant Colony Optimization), zu Deutsch „Ameisenalgorithmus“ ist ein möglicher Lösungsansatz zum Finden einer relativ kürzesten Route bei einem TSP Problem.

Seine Funktionsweise ist eine Analogie zur Futtersuche realer Ameisen und beruht auf Priorisierung besserer Wege durch Verteilung von Hormonen für ihre Nachfolger.

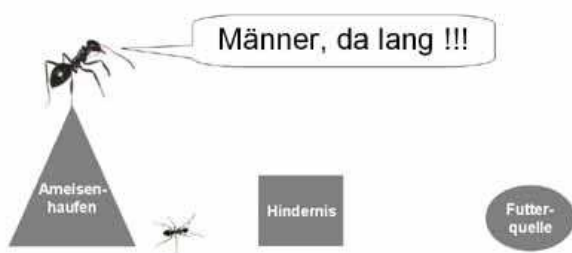


Abbildung Grafische Abbildung der Suche nach Futterquellen

Da kürzere Strecken bei der Futtersuche öfters besucht werden (für Hin- und Rückweg auf der kurzen Strecke braucht die Ameise gleich lange, wie die Ameise auf dem langen Weg NUR für die Hin-Tour), finden nachfolgende Ameisen einen höheren Hormon- (Pheromon-) Gehalt auf diesen und schlagen bei der nächsten Suche nicht mehr den langen, sondern den kurzen und mit viel Pheromon behafteten Weg ein. Nach einer bestimmten Zeit kristallisiert sich der kürzeste Weg mit dem höchsten Pheromon-Gehalt aus, der allen Ameisen den kürzesten Weg, vorbei an den Hindernissen, vom Ameisenhaufen zur Futterquelle weist.

Dieser Vorgehensweise bedient sich der Ameisenalgorithmus bei der Berechnung eines TSP-Problems.

Dabei marschieren virtuelle Ameisen von zufällig aus der Liste aller möglichen Orte ausgewähltem Ort aus in Richtung aller noch möglichen Orte und entscheiden je nach Länge und vorhandenem Pheromon-Gehalt der gelaufenen Strecke, welches die optimalste Route ist, ähnlich der Futtersuche in der Natur.

Agile Softwareentwicklung

Agile Softwareentwicklung ist der Oberbegriff für den Einsatz von Agilität in der Softwareentwicklung.

Das Wort „agil“ stammt aus dem Lateinischen „agilis“ und bedeutet „flink, gewandt, beweglich“. Dies macht auch das Ziel des Softwareentwicklungsprozesses deutlich: Eine flexiblere Entwicklung der Software, als man es von den klassischen Vorgehensmodellen her kennt.

Erste Ansätze zu Agiler Softwareentwicklung finden sich bereits Anfang der 90er Jahre, doch erst mit der Niederschrift des Manifestes im Jahr 2001 begann die Verbreitung dieser neuen Methoden.

Das Agile Manifest beinhaltet 4 Werte, die den Kern der Agilen Softwareentwicklung bilden:

- Individuen und Interaktionen mehr als Prozesse und Werkzeuge
- Funktionierende Software mehr als umfassende Dokumentation
- Zusammenarbeit mit dem Kunden mehr als Vertragsverhandlung

- Reagieren auf Veränderung mehr als das Befolgen eines Plans

Aus diesem Manifest entwickelten sich im Laufe der nächsten Jahre viele Agile Methoden wie „Adaptives Software Development (FDD)“, „Feature Driven Development (FDD)“, „Scrum“ und die agilste Technik, welche in diesem Projekt verwendet wurde, das eXtreme Programming (XP).

PROJEKTMANAGEMENT

Da die Entwicklung der Software mit Hilfe der Agilen Methode XP durchgeführt werden sollte, wurden Techniken festgehalten, die der XP Methode entsprachen.

Im Vordergrund standen dabei das Planning Game mit Story Cards, Collective Ownership mit der flexiblen Rollenverteilung, wöchentliche Stand-Up-Meetings, Coding Standards, Pair Programming, und das Refactoring im Zusammenspiel mit dem Testing.

Auch wurde sich für die Möglichkeit der Continuous Integration für eine bekannte Versionssoftware entschieden.

Rollenverteilung

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XP-Techniken

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Story-Cards

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Verwendete Software

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Before you begin to format your paper, first write and save the content as a separate text file. Keep your text and graphic files separate until after the text has been formatted and styled. Do not use hard tabs, and limit use of hard returns to only one return at the end of a paragraph. Do not add any kind of pagination anywhere in the paper. Do not number text heads- the template will do that for you.

Finally, complete content and organizational editing before formatting. Please take note of the following items when proofreading spelling and grammar:

Zeitlicher Ablauf

Define abbreviations and acronyms the first time they are used in the text, even after they have been defined in the abstract. Abbreviations such as IEEE, SI, MKS, CGS, sc, dc,

and rms do not have to be defined. Do not use abbreviations in the title or heads unless they are unavoidable.

Implementierung

Use either SI (MKS) or CGS as primary units. (SI units are encouraged.) English units may be used as secondary units (in parentheses). An exception would be the use of English units as identifiers in trade, such as “3.5-inch disk drive”.

Avoid combining SI and CGS units, such as current in amperes and magnetic field in oersteds. This often leads to confusion because equations do not balance dimensionally. If you must use mixed units, clearly state the units for each quantity that you use in an equation.

Do not mix complete spellings and abbreviations of units: “Wb/m²” or “webers per square meter”, not “webers/m²”. Spell out units when they appear in text: “. . . a few henries”, not “. . . a few H”.

Use a zero before decimal points: “0.25”, not “.25”. Use “cm³”, not “cc”. (*bullet list*)

GUI

The equations are an exception to the prescribed specifications of this template. You will need to determine whether or not your equation should be typed using either the Times New Roman or the Symbol font (please no other font). To create multileveled equations, it may be necessary to treat the equation as a graphic and insert it into the text after your paper is styled.

Number equations consecutively. Equation numbers, within parentheses, are to position flush right, as in (1), using a right tab stop. To make your equations more compact, you may use the solidus (/), the exp function, or appropriate exponents. Italicize Roman symbols for quantities and variables, but not Greek symbols. Use a long dash rather than a hyphen for a minus sign. Punctuate equations with commas or periods when they are part of a sentence, as in

$$\alpha + \beta = \chi. \quad (1)$$

$$\alpha + \beta = \chi. \quad (1)$$

Note that the equation is centered using a center tab stop. Be sure that the symbols in your equation have been defined before or immediately following the equation. Use “(1)”, not “Eq. (1)” or “equation (1)”, except at the beginning of a sentence: “Equation (1) is . . .”

Algorithmus

The word “data” is plural, not singular.

The subscript for the permeability of vacuum μ_0 , and other common scientific constants, is zero with subscript formatting, not a lowercase letter “o”.

In American English, commas, semi-/colons, periods, question and exclamation marks are located within quotation marks only when a complete thought or name is cited, such as a title or full quotation. When quotation marks are used, instead of a bold or italic typeface, to highlight a word or phrase,

punctuation should appear outside of the quotation marks. A parenthetical phrase or statement at the end of a sentence is punctuated outside of the closing parenthesis (like this). (A parenthetical sentence is punctuated within the parentheses.)

A graph within a graph is an “inset”, not an “insert”. The word alternatively is preferred to the word “alternately” (unless you really mean something that alternates).

Do not use the word “essentially” to mean “approximately” or “effectively”.

In your paper title, if the words “that uses” can accurately replace the word “using”, capitalize the “u”; if not, keep using lower-cased.

Be aware of the different meanings of the homophones “affect” and “effect”, “complement” and “compliment”, “discreet” and “discrete”, “principal” and “principle”.

Do not confuse “imply” and “infer”.

The prefix “non” is not a word; it should be joined to the word it modifies, usually without a hyphen.

There is no period after the “et” in the Latin abbreviation “et al.”.

The abbreviation “i.e.” means “that is”, and the abbreviation “e.g.” means “for example”.

Testing

An excellent style manual for science writers is [7].

SCHLUSS

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Fazit

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For author/s of only one affiliation (Heading 3): To change the default, adjust the template as follows.

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Highlight author and affiliation lines of affiliation 1 and copy this selection.

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Ausblick

Headings, or heads, are organizational devices that guide the reader through your paper. There are two types: component heads and text heads.

Component heads identify the different components of your paper and are not topically subordinate to each other. Examples include Acknowledgments and References and, for these, the correct style to use is “Heading 5”. Use “figure caption” for your Figure captions, and “table head” for your table title. Run-in heads, such as “Abstract”, will require you to apply a style (in this case, italic) in addition to the style provided by the drop down menu to differentiate the head from the text.

Text heads organize the topics on a relational, hierarchical basis. For example, the paper title is the primary text head because all subsequent material relates and elaborates on this one topic. If there are two or more sub-topics, the next level head (uppercase Roman numerals) should be used and, conversely, if there are not at least two sub-topics, then no subheads should be introduced. Styles named “Heading 1”, “Heading 2”, “Heading 3”, and “Heading 4” are prescribed.

Figures and Tables

Positioning Figures and Tables: Place figures and tables at the top and bottom of columns. Avoid placing them in the middle of columns. Large figures and tables may span across both columns. Figure captions should be below the figures; table heads should appear above the tables. Insert figures and tables after they are cited in the text. Use the abbreviation “Fig. 1”, even at the beginning of a sentence.

TABLE TYPE STYLES

Table Head	Table Column Head		
	Table column subhead	Subhead	Subhead
copy	More table copy ^a		

a. Sample of a Table footnote. (Table footnote)

Example of a figure caption. (figure caption)

Figure Labels: Use 8 point Times New Roman for Figure labels. Use words rather than symbols or abbreviations when writing Figure axis labels to avoid confusing the reader. As an example, write the quantity “Magnetization”, or “Magnetization, M”, not just “M”. If including units in the label, present them within parentheses. Do not label axes only with units. In the example, write “Magnetization (A/m)” or “Magnetization {A[m(1)]}”, not just “A/m”. Do not label axes with a ratio of quantities and units. For example, write “Temperature (K)”, not “Temperature/K”.

ACKNOWLEDGMENT (HEADING 5)

The preferred spelling of the word “acknowledgment” in America is without an “e” after the “g”. Avoid the stilted expression, “One of us (R. B. G.) thanks . . .” Instead, try “R. B. G. thanks”. Put sponsor acknowledgments in the unnumbered footnote on the first page.

REFERENCES

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Number footnotes separately in superscripts. Place the actual footnote at the bottom of the column in which it was cited. Do not put footnotes in the reference list. Use letters for table footnotes.

Unless there are six authors or more give all authors' names; do not use “et al.”. Papers that have not been published, even if they have been submitted for publication, should be cited as “unpublished” [4]. Papers that have been accepted for publication should be cited as “in press” [5]. Capitalize only the first word in a paper title, except for proper nouns and element symbols.

For papers published in translation journals, please give the English citation first, followed by the original foreign-language citation [6].

G. Eason, B. Noble, and I. N. Sneddon, “On certain integrals of Lipschitz-Hankel type involving products of Bessel functions,” *Phil. Trans. Roy. Soc. London*, vol. A247, pp. 529–551, April 1955. (references)

J. Clerk Maxwell, *A Treatise on Electricity and Magnetism*, 3rd ed., vol. 2. Oxford: Clarendon, 1892, pp.68–73.

I. S. Jacobs and C. P. Bean, “Fine particles, thin films and exchange anisotropy,” in *Magnetism*, vol. III, G. T. Rado and H. Suhl, Eds. New York: Academic, 1963, pp. 271–350.

K. Elissa, “Title of paper if known,” unpublished.

R. Nicole, “Title of paper with only first word capitalized,” *J. Name Stand. Abbrev.*, in press.

Y. Yorozu, M. Hirano, K. Oka, and Y. Tagawa, "Electron spectroscopy studies on magneto-optical media and plastic substrate interface," IEEE Transl. J. Magn. Japan, vol. 2, pp. 740–741, August 1987 [Digests 9th Annual Conf. Magnetics Japan, p. 301, 1982].

M. Young, *The Technical Writer's Handbook*. Mill Valley, CA: University Science, 1989.