Purpose of technical writing

- Transmit technical information accurately using written symbols.

- Different from
  - Popular fiction/non-fiction (entertainment)
  - Advertising (sell)

- Sacrifice style, grace, and technique for clarity, precision, and organization
Principles of Technical Writing

• Use the active voice.

• Passive: Dolphins were taught by researchers in Hawaii to learn new behavior.

• Active: Researchers in Hawaii taught dolphins to learn new behavior.
Principles of Technical Writing

• Use plain rather than elegant or complex language.

• Elegant: The corporation deemed it necessary to terminate Joseph Smith.

• Plain: Joseph Smith was fired.
Principles of Technical Writing

• Delete words, sentences, and phrases that do not add to your meaning.

• Wordy: It is most useful to keep in mind that the term diabetes mellitus refers to a whole spectrum of disorders.

• Concise: Diabetes mellitus refers to a whole spectrum of disorders.
Principles of Technical Writing

• Know your reader. How much do you have to explain?

• Can you say “operating system” or do you need to define it?

• Do not invent words.

• Break your writing into short sections.
When will you need to use Technical Writing?

- a thesis
- a scientific paper
- a letter to editor / collaborator / reviewer
- a grant proposal
- a cover letter/research statement
- a patent submission
- a blog post, news article
Writing a Scientific Paper

Dynamic Programming Algorithm Optimization for Spoken Word Recognition

Hiroaki Sakoe and Seiichi Chiba

Abstract—This paper reports on an optimum dynamic programming (DP) based time-normalization algorithm for spoken word recognition. First, a general principle of time-normalization is given using time-warping function. Then, two time-normalized distance definitions, called symmetric and asymmetric forms, are derived from the principle. These two forms are compared with each other through theoretical discussions and experimental studies. The symmetric form algorithm superiority is established. A new technique, called slope constraint, is successfully introduced, which the warping-function slope is restricted so as to improve discrimination between words in different categories. The effective slope constraint characteristics is qualitatively analyzed, and the optimum slope constraint condition is determined through experiments. The optimized algorithm is then extensively subjected to experimental comparison with various DP-algorithms, previously applied to spoken word recognition by different research groups. The experiment shows that the present algorithm gives no more than about two-thirds error, even compared to the best conventional algorithm.

I. INTRODUCTION

It is well known that speaking rate variation causes nonlinear fluctuation in a speech pattern time axis. Elimination of this fluctuation, or time-normalization, has been one of the central problems in spoken word recognition research. At an early stage, some linear normalization techniques were examined, in which timing differences between speech patterns were eliminated by the linear transformation of the time axis. Reports on these efforts indicated that any linear transformation is inherently insufficient for dealing with highly complicated fluctuation nonlinearly as well as that time-normalization significantly improves recognition accuracy.

DP-matching, discussed in this paper, is a pattern matching algorithm with a nonlinear time-normalization effect. In this algorithm, the time-axis fluctuation is approximately modeled with a nonlinear warping function of some carefully specified properties. Timing differences between two speech patterns are eliminated by warping the time axis of one so that the maximum coincidence is attained with the other. Then, the time-normalized distance is calculated as the minimized residual distance between them. This minimization process is very efficiently carried out by use of the dynamic programming (DP) technique. The basic idea of DP-matching has been reported in several publications [1]-[3], where it is has been shown by preliminary experiment on Japanese digit words that a recognition accuracy as high as 99.8 percent has been achieved, indicating the DP-matching effectiveness.

This paper reports an optimum algorithm for DP-matching through theoretical discussions and experimental studies. Manuscript received February 17, 1977; revised September 7, 1977. The authors are with Central Research Laboratories, Nippon Electric Company, Limited, Kawasaki, Japan.
Writing a Scientific Paper

Fig. 1. The shape of a research article or thesis.
Writing a Scientific Paper

• Writing a Scientific Paper is an Exercise in communication

• The goal is to communicate a complex idea, and convince the reader that this new idea is worth the reader’s time.

• To write a paper, the only thing you need is become an expert in writing each of these sections:

  • abstract / introduction / methodology / experiments / discussion / conclusion.

• Unlike “writing” the goal of scientific writing is well defined.
The Abstract
Elevator Talk

• What is an **elevator talk**, and what does it have to do with writing a paper? A lot.

• Imagine you are the president of the nonprofit *Light Is The Solution Foundation*.

• The board of directors is meeting at the New York Hilton, and you are waiting to ride the elevator from the 31st floor to the lobby.
Elevator Talk

- The doors open, and you find yourself standing with **Bill Gates**, head of the philanthropic (博愛) Gates Foundation.

- The **Gates Foundation** meeting at the same hotel.

- Gates notices the logo on your shirt of a small child reading a book by the light of a lantern and asks you, “What is that? What do you do?”
• Indeed, **what do you do now?** You have 30 floors, or ~1 minute, to give him your message and explain what you do.

• This might be a **unique chance** to get his attention.
Elevator Talk

• So you explain that normal living activities cease in many countries in the world after the sun goes down. Children have no light to read textbooks, mothers no light to cook, fathers no light to earn income.

• With this background, you then explain that the Light Is The Solution Foundation has addressed this problem by developing rechargeable LED lanterns that are low-cost, have a battery life of 30 hours, and put out light equivalent to three 60-W bulbs.

• You have given away 4500 lanterns in one country and have results showing that more children now share books, study together, and graduate at a higher rate. In fact, average incomes have risen by 20% for families who have received a lantern.

• You have concluded that this unique program could be expanded to any country that has even the crudest electrical grid or generators for recharging the lanterns.
Elevator Talk

- This is the **elevator talk**.
- Your **1-minute** opportunity to summarize what you do, how you do it, the results you produce, and the impact you make.
- A well-developed **elevator talk** entices the listener to want to learn more.
- In many professions, entire careers are made and lost as a result of elevator talks.

**ABSTRACT = ELEVATOR TALK**
Abstract

Table 1. Characteristics of a well-written abstract.

<table>
<thead>
<tr>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stands on its own without need to read the paper</td>
</tr>
<tr>
<td>States the hypothesis, question, or objective of the study</td>
</tr>
<tr>
<td>Completes the story by answering the hypothesis, question, or objective</td>
</tr>
<tr>
<td>Contains the same key words and terms as the title and the introduction</td>
</tr>
<tr>
<td>Follows the correct style and format</td>
</tr>
<tr>
<td>Follows the order of the main text (e.g., IMRAD)</td>
</tr>
<tr>
<td>Stays within the allowed word count</td>
</tr>
<tr>
<td>Does not contain information absent in the paper</td>
</tr>
<tr>
<td>Does not make conclusions unsupported by the data</td>
</tr>
<tr>
<td>Limits the use of abbreviations</td>
</tr>
<tr>
<td>Does not include references</td>
</tr>
<tr>
<td>Does not cite tables or figures</td>
</tr>
</tbody>
</table>

IMRAD format (Introduction, Methods, Results, and Discussion)
Abstract

Support-vector networks
C. Cortes, V. Vapnik - Machine learning, 1995 - Springer

Abstract The support-vector network is a new learning machine for two-group classification problems. The machine conceptually implements the following idea: input vectors are non-linearly mapped to a very high-dimension feature space. In this feature space a linear ...

Cited by 13476 Related articles All 40 versions Web of Science: 5016 Cite Saved
Abstract

SUPPORT-VECTOR NETWORKS

Corinna Cortes ¹ and Vladimir Vapnik ²
AT&T Labs-Research, USA

Abstract. The support-vector network is a new learning machine for two-group classification problems. The machine conceptually implements the following idea: input vectors are non-linearly mapped to a very high-dimension feature space. In this feature space a linear decision surface is constructed. Special properties of the decision surface ensures high generalization ability of the learning machine. The idea behind the support-vector network was previously implemented for the restricted case where the training data can be separated without errors. We here extend this result to non-separable training data.

High generalization ability of support-vector networks utilizing polynomial input transformations is demonstrated. We also compare the performance of the support-vector network to various classical learning algorithms that all took part in a benchmark study of Optical Character Recognition.
Introduction

Fig. 1. The shape of a research article or thesis.

Science research writing for non-native speakers of English by Hilary Glasman-Deal.
Write an Introduction

- Overall Structure
- Grammar and important language skills
- Build a Model
Structure

• How do writers usually start an introduction?
• What types of information should be in my introduction?
• How do writers usually end an introduction?
Structure

• Introduction & Conclusion are asymmetric (非对称)

• Start with general topics, converge to your contribution or point.

• Highlight the importance of the problem you discuss and explain as simply as possible your contribution

• Close by laying out the structure
Example 1 provides the introduction for a hypothetical study of a biomarker in vascular inflammation. Compare the format of this introduction to the cone concept in Fig. 1. The first sentence (top of the cone) tells the reader that the study relates to the broader topic of cardiovascular disease, which is an important health problem. The next sentence narrows the topic to chronic inflammation, which is linked to cardiovascular disease, followed by a sentence that focuses the topic further to H₉₂₅ selectin, a marker of inflammation that is increased in the serum of patients with peripheral vascular disease. Besides referenced association studies,

| Background, known information |
| Knowledge gap, unknown information |
| Hypothesis, question, purpose statement |
| Approach, plan of attack, proposed solution |

Fig. 1. The introduction: a cone or funnel.

“It was a cold and rainy night”:
Set the Scene with a Good Introduction Thomas M. Annesley
The synthesis of flexible polymer blends from polylactide and rubber

Introduction

1 Polylactide (PLA) has received much attention in recent years due to its biodegradable properties, which offer important economic benefits. 2 PLA is a polymer obtained from corn and is produced by the polymerisation of lactide. 3 It has many possible uses in the biomedical field and has also been investigated as a potential engineering material. 4 However, it has been found to be too weak under impact to be used commercially.

5 One way to toughen polymers is to incorporate a layer of rubber particles and there has been extensive research regarding the rubber modification of PLA. 6 For example, Penney et al. showed that PLA composites could be prepared using blending techniques and more recently, Hillier established the toughness of such composites. 7 However, although the effect of the rubber particles on the mechanical properties of copolymer systems was demonstrated over two years ago, little attention has been paid to the selection of an appropriate rubber component.

8 The present paper presents a set of criteria for selecting such a component. 9 On the basis of these criteria it then describes the preparation of a set of polymer blends using PLA and a hydrocarbon rubber (PI). 10 This combination of two mechanistically distinct polymerisations formed a novel copolymer in which the incorporation of PI significantly increased flexibility.
Example 1

Cardiovascular disease is a public health problem worldwide. Chronic inflammation has been linked to cardiovascular disease and sudden cardiac death (1–3). Recent studies have demonstrated that a strong association exists between β-selectin, a recognized systemic marker of inflammation, and cardiovascular disease (4–6), and that patients with peripheral vascular disease have increased serum concentrations of β-selectin that correlate with the degree of functional impairment (7,8). Additionally, prospective studies have presented data regarding the prognostic value of β-selectin in predicting the severity of underlying cardiovascular disease and risk of mortality. The Vascular Inflammation Prediction (VIP) Study found a positive correlation between concentrations of β-selectin and the risk of developing cardiovascular disease (9). The Canadian All-Cause Mortality Study revealed that individuals with serum β-selectin concentrations >90 µg/L are 4.5 times as likely to die within 5 years as those with concentrations ≤90 µg/L (10).

Whereas these association and prospective studies indicate that β-selectin is a predictor of cardiovascular disease and risk of mortality, they provide little information about the underlying pathophysiology of vascular inflammation and the contributory role, if any, of β-selectin.

We therefore investigated in an animal model whether β-selectin is a cause or just a marker of vascular inflammation associated with cardiovascular disease.

Using a herpes simplex virus type 2 infection protocol to stimulate continuous β-selectin production in mice, we investigated the effects of β-selectin production on the development of atherosclerotic lesions, life span, and potential mechanisms of β-selectin–induced inflammation.
Passive / Active

• I describe an algorithm to cluster sequences
• We describe an algorithm to cluster sequences
• An algorithm to cluster sequences is described
• This paper describes an algorithm to cluster sequences
Passive / Active

- I describe an algorithm to cluster sequences
- We describe an algorithm to cluster sequences
- An algorithm to cluster sequences is described
- This paper describes an algorithm to cluster sequences
Only Use We for you!

- We know that algorithms to cluster sequences are important
- In that case, Passive is useful:
- It is well known that clustering sequences is an important algorithmic problem
Using Paragraphs

• What is a paragraph? a unit of text. Usually a few sentences

• Why use paragraphs? make it easier for your reader to parse your text

• Having said that: how do readers usually look at articles?
1. READ THE TITLE
   and try to predict the type of information you expect to see
2. LOOK AT THE NAME OF THE AUTHOR
   What you know about the writer will help you predict and evaluate the content.
3. CHECK THE DATE
   and use it to help you assess the content.
4. READ THE ABSTRACT
   to find out what the researchers did and/or what they found
5. LOOK QUICKLY AT THE FIRST PARAGRAPH
   without trying to understand all the words.
6. LOOK QUICKLY AT THE FIRST SENTENCE OF EACH PARAGRAPH
   without trying to understand all the words
7. LOOK QUICKLY AT EACH FIGURE/TABLE AND READ ITS TITLE
   to try and find out what type of visual data is included
8. READ THE LAST PARAGRAPH
   especially if it has a subtitle like ‘Summary’ or ‘Conclusion’
The Crime Novel

- Suppose someone gives you a crime novel
- Suppose you read first the end
  - You know who did the crime, why, how
- Start reading the novel from the start now
- Will you read the novel faster?
Structure

• What *types of information should be in* my introduction?
The synthesis of flexible polymer blends from polylactide and rubber

**Introduction**

1. Polylactide (PLA) has received much attention in recent years due to its biodegradable properties, which offer important economic benefits. 2. PLA is a polymer obtained from corn and is produced by the polymerisation of lactide. 3. It has many possible uses in the biomedical field and has also been investigated as a potential engineering material. 4. However, it has been found to be too weak under impact to be used commercially.

5. One way to toughen polymers is to incorporate a layer of rubber particles and there has been extensive research regarding the rubber modification of PLA. 6. For example, Penney et al. showed that PLA composites could be prepared using blending techniques and more recently, Hillier established the toughness of such composites.

7. However, although the effect of the rubber particles on the mechanical properties of copolymer systems was demonstrated over two years ago, little attention has been paid to the selection of an appropriate rubber component.

8. The present paper presents a set of criteria for selecting such a component.
In Sentence 1 ‘Polylactide (PLA) has received much attention in recent years due to its biodegradable properties, which offer important economic benefits.’ the writer establishes the importance of this research topic.
In Sentence 2 ‘PLA is a polymer obtained from corn and is produced by the polymerisation of lactide.’ the writer provides general background information for the reader.
In Sentence 3 ‘PLA has many possible uses in the biomedical field\(^1\) and has also been investigated as a potential engineering material \(^2,^3\)’ the writer does the same as in Sentences 1 and 2, but in a more specific/detailed way, using research references to support both the background facts and the claim for significance.
In Sentence 4 ‘However, it has been found to be too weak under impact to be used commercially.’ the writer describes the general problem area or the current research focus of the field.
Building A Model

In Sentence 5 ‘One way to toughen polymers is to incorporate a layer of rubber particles.’ the writer provides a transition between the general problem area and the literature review.
In Sentence 6 ‘For example, Penney et al. showed that PLA composites could be prepared using blending techniques\textsuperscript{6} and more recently, Hillier\textsuperscript{7} established the toughness of such composites.’ the writer provides a brief overview of key research projects in this area.
In Sentence 7 ‘However, although the effect of the rubber particles on the mechanical properties of copolymer systems was demonstrated over two years ago, little attention has been paid to the selection of an appropriate rubber component.’ the writer describes a gap in the research.
In Sentence 8 ‘The present paper presents a set of criteria for selecting such a component.’ the writer describes the paper itself.
In Sentence 9 ‘On the basis of these criteria it then describes the preparation of a set of polymer blends using PLA and a hydrocarbon rubber(PI).’ the writer gives details about the methodology reported in the paper.
In Sentence 10 ‘This combination of two mechanistically distinct polymerisations formed a novel copolymer in which the incorporation of PI significantly increased flexibility.’ the writer announces the findings.
Building A Model

In Sentence 1 the writer establishes the importance of this research topic.
In Sentence 2 the writer provides general background information.
In Sentence 3 the writer does the same as in Sentences 1 and 2, but in a more specific/detailed way.
In Sentence 4 the writer describes the general problem area or the current research focus of the field.
In Sentence 5 the writer provides a transition between the general problem area and the literature review.
In Sentence 6 the writer provides a brief overview of key research projects in this area.
In Sentence 7 the writer describes a gap in the research.
In Sentence 8 the writer describes the paper itself.
In Sentence 9 the writer gives details about the methodology reported in the paper.
In Sentence 10 the writer announces the findings.
# A Model For the Introduction

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
</table>
| 1 | ESTABLISH THE IMPORTANCE OF YOUR FIELD  
   | PROVIDE BACKGROUND FACTS/INFORMATION  
   | (possibly from research)  
   | DEFINE THE TERMINOLOGY IN THE TITLE/KEY WORDS  
   | PRESENT THE PROBLEM AREA/CURRENT RESEARCH FOCUS |
| 2 | PREVIOUS AND/OR CURRENT RESEARCH AND CONTRIBUTIONS |
| 3 | LOCATE A GAP IN THE RESEARCH  
   | DESCRIBE THE PROBLEM YOU WILL ADDRESS  
   | PRESENT A PREDICTION TO BE TESTED |
| 4 | DESCRIBE THE PRESENT PAPER |
Methodology: Your Work

1. **How do I start the Methodology/Experiments section?** What type of sentence should I begin with?
2. **What type of information should be in this section, and in what order?**
3. **How do I end this section?**

You already know that the Methodology should contain a detailed description of what you did and/or used, and this helps to answer the second of the three questions. As we will see, however, it is not a full answer; to be effective and conform to what is normally done in a research paper, this section must contain other important information as well.

Read the example below.

**Changes in the chemistry of groundwater in the chalk of the London Basin.** Don’t worry if the subject matter is not familiar to you or if you have difficulty understanding individual words, especially technical terms like groundwater. Just try to get a general understanding at this stage and familiarise yourself with the type of language used.

- **RESULTS** (what you found/saw)
- **METHODOLOGY** (what you did/used)
- **DISCUSSION/CONCLUSION**
- **ABSTRACT**

---

**Fig. 1.** The shape of a research article or thesis.
Your Work as a Student

• Up to now, you have mostly written about science to prove that you have understood known concepts.

• Your professor knows how to fill the gaps, understand what you write even if it’s not clear.
Work as a Scientist/Engineer

- Writing a scientific paper is different: you will be the professor, the teacher.
Work as a Scientist/Engineer

• Writing a scientific paper is different: you will be the professor, the teacher.

• Becomes crucial that you can provide all necessary information
### who what when where how & why

<table>
<thead>
<tr>
<th>Who</th>
</tr>
</thead>
<tbody>
<tr>
<td>Who maintained the records? Who reviewed the data? Who collected</td>
</tr>
<tr>
<td>the specimens? Who enrolled the study participants? Who supplied</td>
</tr>
<tr>
<td>the reagents? Who made the primary diagnosis? Who did the statistical</td>
</tr>
<tr>
<td>analyses? Who reviewed the protocol for ethics approval? Who</td>
</tr>
<tr>
<td>provided the funding?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>What</th>
</tr>
</thead>
<tbody>
<tr>
<td>What reagents, methods, and instruments were used? What type of</td>
</tr>
<tr>
<td>study was it? What were the inclusion and exclusion criteria for</td>
</tr>
<tr>
<td>enrolling study participants? What protocol was followed? What</td>
</tr>
<tr>
<td>treatments were given? What endpoints were measured? What data</td>
</tr>
<tr>
<td>transformation was performed? What statistical software package</td>
</tr>
<tr>
<td>was used? What was the cutoff for statistical significance? What</td>
</tr>
<tr>
<td>control studies were performed? What validation experiments were</td>
</tr>
<tr>
<td>performed?</td>
</tr>
</tbody>
</table>
Table 1. When, Where, and Why Questions to Consider When Writing the Methods Section

<table>
<thead>
<tr>
<th>When</th>
<th>Where</th>
</tr>
</thead>
<tbody>
<tr>
<td>When were specimens collected?</td>
<td>Where were the records kept?</td>
</tr>
<tr>
<td>When were the analyses performed?</td>
<td>Where were the specimens analyzed?</td>
</tr>
<tr>
<td>When was the study initiated?</td>
<td>Where were the study participants enrolled?</td>
</tr>
<tr>
<td>When was the study terminated?</td>
<td>Where was the study performed?</td>
</tr>
<tr>
<td>When were the diagnoses made?</td>
<td></td>
</tr>
</tbody>
</table>
### Who, What, When, Where, How, & Why

**How**

- How were samples collected, processed, and stored?
- How many replicates were performed?
- How was the data reported?
- How were the study participants selected?
- How were patients recruited?
- How was the sample size determined?
- How were study participants assigned to groups?
- How was response measured?
- How were endpoints measured?
- How were control and disease groups defined?

**Why**

- Why was a species chosen (mice vs rats)?
- Why was a selected analytical method chosen?
- Why was a selected experiment performed?
- Why were experiments done in a certain order?