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Editor's Foreword

This issue features one article and two reports about the activities of the Society.

Miss P.Y. Lai and Prof. Stephen Lee write an interesting article on the application of Statistics in Communication. They first describe how a communication process works and then explain how the theory of probability and statistics can be applied in the communication theory. They ended the article by giving an example illustrating the usage of probability and statistics in error correction problem.

The first round of professional statistical examination taken over by the Society from the RSS was successfully conducted in May, 2002. Ms. Cecilia Chan, Secretary of the HKSS Examination Board, writes a progress report on the development of the examination. She also reports the briefing seminar to promote the 2003 round of the examination.

A boat trip to Ap Chau, Kat O and Tung Ping Chau was organized by our Programme Secretary, Mr. C.N. Lo on the Mid-Autumn Festival. He writes a report on the trip and provides some pictures about the trip. We can share the joy of this wonderful activity with members who cannot participate in the trip.

You might not realize that the Society will enter its twenty-fifth year since found in the coming year. A series of activities are planned to celebrate its silver jubilee. The first of them will be a workshop jointly organized with the Hong Kong Institute for Monetary Research (HKIMR) on Feb 15, 2003. You can find all the details about the workshop in this issue.

P.S. Chan

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President's Forum

Professor W.K. Li

Time flies and 2003 is almost here.

On Feb 15, 2003 there will be a workshop on financial and economic statistics jointly organised by the Society and the Hong Kong Institute for Monetary Research (HKIMR). For us, this will be an event celebrating the 25th anniversary of the Society and we are grateful for the HKIMR in making this possible.

The state of the Society is healthy in general. The professional examination is entering into the second year and the Statistical Project Competition (SPC) is going on fine despite all the difficulties. I would like to thank all members involved in these two for their hard work and services for the Society.

One particular item of concern is that although we are grateful for the Hang Seng Bank in supporting the SPC in the past, it is now certain that we would need to find more sponsors next year. Again, we would need your suggestions and support on this matter.

Finally, I would like to take this opportunity to wish you all a happy and prosperous New Year and a Merry Christmas!

Application of Statistics in Communication

P.Y. Lai and S.M.S. Lee
The University of Hong Kong

Introduction

Communication is the exchange of thoughts, messages and information. Many communication systems, such as mail, telephone or television, have been extensively developed for sending and receiving messages. For efficient communication, we usually encode source information by means of "codewords" in the form of finite strings of letters. In some situations where the coded messages have to be transmitted through a noisy channel, the original signal may be distorted by streams of random noise during transmission. Reliable decoding rules therefore need to be found to decode the distorted message. Within the framework of communication theory, probability and statistical methods have been applied successfully to develop efficient encoders and reliable decoders, making considerable contribution to modern communication technology.

This article presents, in the simplest terms, the very basic communication concepts and illustrates the important roles played by the disciplines of probability and statistics in this area through very simple examples. We emphasize that we shall not and have indeed no expertise to discuss the state-of-the-art communication theory in this article, but shall rather give a brief and preliminary introduction in the hope of arousing readers' interest in this subject area.

A conventional signaling system

In a typical communication process, a sender has to transmit a signal, or information, by means of a communication channel, to a receiver, who must learn to decipher the signal and make it understandable.

A conventional signaling system generally comprises six components:

1. an information source,
2. an encoder of source information,
3. a channel over, or through, which the coded information is sent,
4. a noise (error) source that adds noise to the signal being transmitted in the channel,
5. a decoder which hopefully recovers the original information from the contaminated signal received,
6. a sink for the decoded information.

Subsequent sections focus on the second and fifth components and discuss briefly how the concepts of probability and statistics lead to the establishment of efficient encoders and

reliable decoders.

Transmission process

Coding is most economically undertaken and the relevant theory is most easily presented by means of two states, especially when transmission is carried out electronically. It is customary to use the bits ‘0’ and ‘1’ to label the two states. All codewords then take the form of strings of ‘0’s and ‘1’s. We model the source by a random, or stochastic, mechanism, and investigate how we may encode, transmit, and recover the original information. Specific messages, or signals, are sent but we have no control over which of the ensemble of possible messages to be sent. Thus, the particular message under consideration can be viewed as a random sample taken from the population of all possible messages. We must design the system carefully to handle each one of these possible messages. Although different kinds of codes have been invented to deal with different situations, all have the common objective to communicate messages efficiently and reliably. The Morse Code is a famous example and has a long history. Another example is the Bar Code which has found countless applications in our daily life. Every household commodity is now assigned a bar code, which definitely makes inventory management and transactions more efficient and accurate.

On the other hand, it is not easy to build equipments which are perfectly reliable. Even highly reliable transmission systems cannot guarantee perfect transmission. Error detection becomes very important when the received coded messages are contaminated by noises. It is not possible to detect an error if every possible combination of coding bits that can be received relates to a legitimate source signal. It is only possible to catch errors if there are restrictions artificially imposed on valid codewords. Therefore, practically useful codes should be carefully designed so that they can take care of possible transmission errors and allow reliable decoding at the receiver’s end. A common error-detecting method, known as the Parity Check, appends to any codeword an extra “parity-digit” or “check-digit” such that there must be an even number of ‘1’ bits in any valid codeword.

Example: Linear codes — Hamming code

As has been mentioned above, when source signals have been distorted by noises in a random way during transmission, the received messages may not be understandable, even after decoding. If a code can be designed to allow for a decoding rule which can correct most of the errors, signal transmission can be made much more reliable.

To fix ideas, we restrict attention to one particular class of codes, known as the linear code, which is capable of detecting and correcting errors and hence forms a useful component to facilitate efficient and accurate communication. One such linear code is exemplified by the Hamming code for encoding English letters, which we tabulate in Table 1 and shall use for illustration.

Table 1: Hamming codewords

Letter	Hamming code	Letter	Hamming code
A	000000000	O	101010100
B	101000000	P	011011000
C	011000010	Q	010100111
D	100100100	R	100101011
E	010101000	S	111110011
F	001110000	T	011001101
G	110000011	U	000010101
H	001100101	V	110011001
I	111101001	W	101001110
J	100110001	X	110010110
K	111100110	Y	000011010
L	001101010	Z	111111100
M	010110010	SPACE	000001111
N	110001100		

We see from Table 1 that each Hamming codeword consists of n=9 binary digits. Specifically, the collection of all legitimate Hamming codewords can be viewed as a linear subspace of the n-dimensional vector space over the binary field. The error-detecting and correcting ability of the Hamming code is thus determined by that non-zero codeword which contains the minimum number of '1' bits. Error-correction is carried out for the Hamming code by multiplying each received codeword with the so-called parity check matrix, which is made up by basis vectors in the orthogonal complement of the Hamming codewords, to yield the syndrome vector. Examination of the syndrome vector then identifies a legitimate Hamming codeword closest to the received codeword and decodes the latter as the former.

As a real example, the Hamming code was used to encode a sample passage of the Chief Executive's Speech of Hong Kong Policy Address 2001. For simplicity, we removed all symbols other than the 26 English letters and 'space'. The encoded passage was viewed as a source of signals to be sent through a noisy channel, in which the signals were to be altered in a random way, before arriving at a receiver.

Figures 1-4 display respectively an extract of the original passage, its corresponding coded but contaminated signal sequence, and the decoded passages without and with error correction. It is clear that the decoded passage without error correction (Figure 3) is completely undecipherable. However, application of the decoding rule of the Hamming code converts the contaminated message into a passage which is more or less understandable: see Figure 4.

We now describe in more detail the communication model considered in the previous example. We first encoded each source letter (from the English alphabet in our case) of the passage by a Hamming codeword. The coded messages were then sent through a binary symmetric channel (BSC). A BSC has two input symbols, viz. 0 and 1, and two output symbols, 0 and 1 again. For any transmitted bit (0 or 1), there is a probability of 1-p that the bit is correctly output, and a probability p that it is switched to the opposite bit. Bit errors are assumed to be independent. Under the BSC,

transmission of signals may be regarded as being subject to a sequence of independent Bernoulli trials with failure probability p. For a source signal encoded by a codeword of length n, the error-rate is given by $1-(1-p)^n$, which can be taken as the 'theoretical' error-rate of the BSC in the absence of error correction at the decoding step. Comparison of the empirical error-rate observed in the Hamming-decoded (i.e. with error correction) passage against the theoretical BSC error-rate demonstrates the impressive gain in accuracy offered by the Hamming encoding/decoding procedure.

Discussion

Communication theory has been widely applied in numerous situations, all of which involve transmission of information emitted from a source over a noisy channel to a receiver. Examples include telephone conversations, storage devices like magnetic tape units which feed stored information to the computer, telegraphs, transmission of satellite pictures, etc. Other important applications have also been found in areas like image processing, pattern recognition, cryptography, quantum computing and genetics.

In most situations, external factors often give rise to disturbances which affect substantially the quality of the signals being transmitted. Complexity of such disturbances often renders their analysis formidable or even impossible without the aid of certain probability modeling techniques. Incorporation of probability models into the communication process subsequently calls for a variety of statistical methods to handle the signal observations being received. In fact, both probability and statistics are indispensable in nurturing a useful coding theory and hence contributing to real life communication. The encoding and decoding process is highly relevant to our classical conception of statistical modeling. An analogy between communication and statistical modeling is shown in the comparison below.

Communication		**Statistical modeling**
Experimental design	---	Encoding
Error generating Mechanism	---	Noisy transmission
Estimation or Prediction	---	Decoding

In this perspective, communication technology is set to benefit from the rich and ever-expanding supply of statistical methods developed within the statistical community. For instance, the Hamming decoding rule is in its very essence a simple application of the maximum likelihood method. That contemporary probability and statistical theories and methodologies can be fully exploited in the area of communication remains to be seen.

Figure 1

The original HKSAR Policy Address 2001 Speech:

Madam President
A Introduction
This is my fifth Policy Address and also my last Policy Address as the first Chief Executive of the Hong Kong Special Administrative Region SAR Government I will maintain the steadfast course I first set on July implementing peopleoriented policies embracing change and rising to meet the challenges with our community My aim is to build a more civil affluent stable democratic Hong Kong that is full of ……

Figure 2

Coded and contaminated signal sequence:

0101100100000000001001001000000000001011001000000111101101100010010101101010100011111001111110100110010010001010100011000110001100110100000011110000000001111010011100011000110011011001010111010101001001001000000101010110000100110011011111010011010101001100011000000011110110011010011001011111010011111100110000011111111010011111100110000011110101100100000110100000011110011100001111010010011100000110011010011001000001111011011000101010100000110101011110100101100001000001101000000111110000000010010010010010010010010101…….

Figure 3

Passage without error correction:

adamr*sid**t a*i**r***c*io* t* s ****y f*f*h*p****y** d**es**and *ls* my po*icy add*****as the *i*s***h*e**e*ecu**vf the *ong **ng*s*e**** a***nstrative region *ar*govr*men** i will*ma***a***th* *t*ad*a** *ou**e*i **r** s***on*july*im*lamenting*** ole*ri**te**policies**mb*aci** ch***e and risi*g to meet *h****lle***** w*th*ou* co*mu*ity my *im*is*t* b*ild a mo*e civi**affl**nt st*bl* **m**ra*I* ho***kon* th*t is **ll …….**

'*'representing an invalid received codeword

Figure 4

Passage after error correction:

madam presidcnt a introductiow this ts my fif h polecy addresi and also my lasp policy addreis as the mirst chlef executive of the ong kong special administrative region sar government i will mainiain thm steadpast course i first sdt on july implementing peoyleoriented policiesuemra cing change and risixg to meet phe challenses withrour community my aim is to uild a more civil affluent stale democraeic hong kong that is full fhvitality on july hong konn was reunited wrth the motherland the colonialrchapteq drew toaa close an toe hong kwng sarywas oorn ……..

Important Developments of the HKSS Professional Statistical Examination

Ms. Cecilia Chan
Secretary, HKSS Examination Board

Since the launching of the HKSS professional statistical examination in October 2001, a number of Working Groups and Committees have been formed to carry out various aspects of work on the Examination Project. With the joint effort and support from members and representatives from all relevant tertiary and vocational institutions and organisations, we have made tremendous progress on the project. A bilingual press release announcing a number of important developments of the HKSS examination was issued to all major newspapers in early October 2002. On behalf of the Project Team on HKSS Examination and Accreditation System, I am glad to report the major developments/events regarding the professional statistical examination offered by our Society.

Full recognition by the Government

Professor W K LI, our President, wrote earlier this year to the Government to request for confirmation on recognition of the qualifications awarded by the Society. We received a reply from the Government in August confirming that the qualifications awarded by the HKSS would be accepted by the Government as meeting the entry requirements of statistical grades staff in the civil service, same as the RSS qualifications. Specifically, candidates with a pass in the Ordinary Certificate level and Graduate Diploma level are considered as meeting the statistical requirements for applying for the posts of Statistical Officer II (recruitment rank for the Statistical Officer Grade) and Statistician (recruitment rank for the Statistician grade) in the Census and Statistics Department respectively. Moreover, the Higher Certificate level qualification is amongst one of the factors to be considered for a Statistical Officer II to be promoted to a Statistical Officer I.

First round of the examination

The first round of professional statistical examination taken over by the HKSS from the RSS was successfully conducted in May 2002. More than 50 examination associates/members of the Society had registered for this round of examination. Eight candidates had successfully completed the Ordinary Certificate level of examination, two, the Higher Certificate level and two, the Graduate Diploma level. A name list of these 12 candidates is at Annex. Congratulations to all of them !

Under an Agreement reached between the HKSS and the RSS in August 2001, the two societies have mutual recognition of the professional qualifications granted by each other, and the certificates issued by the HKSS are fully endorsed by the RSS.

New option paper

Another significant development of the HKSS examination is that as from the May 2003 examination, taking into account the latest trend of development in international standard for statistics, a new subject titled "Social, Economic and Financial Statistics" will be added to the syllabus of the Graduate Diploma for the HKSS examination.

The syllabus for this new subject was designed by the Syllabus Development Committee specifically to address the growing demand for professional knowledge in the analysis of social, economic and financial aspects of the market. The RSS had endorsed the proposed syllabus for the new subject and agreed that it is of an intellectual standard equivalent to those of the syllabuses of the other papers offered for the Graduate Diploma by the two societies. This illustrates the equivalence of professional standard advocated by both the RSS and HKSS.

Briefing seminar

To promote the 2003 round of the professional statistical examination, which will take place in Hong Kong on 13-15 May 2003, and help our examination associates know better of the examination, a briefing seminar was held on 9 October 2002 at the United Centre, Admiralty. About 70 examination associates/members of the Society and students from tertiary institutions attended the seminar. Prof WK LI, the HKSS President and Mr. HW FUNG, Chairman of the Examination Board, briefed participants of the recent developments of the

examination. Senior lecturers from various tertiary institutions including Dr. Stephen WU and Dr. May WONG from the HKU School of Professional and Continuing Education, Mr. Patrick KWAN of the HK Polytechnic University, Ms Teresa NG of the City University, Mr. Raymond TAM of the Hong Kong Institute of Vocational Education and Dr. William LEUNG of the Hong Kong College of Education introduced relevant statistics courses in their institutions to participants. The opportunity was also taken to present Certificates to examination associates who had successfully completed the Ordinary Certificate / Higher Certificate / Graduate Diploma level of examination. At the end of the seminar, some senior members of the Society shared with participants their experience in sitting the examination.

Registration

Interested members who wish to sit the examinations should note that the deadline for examination registration has been advanced this year from 31 March 2003 to 1 March 2003. Details of the registration procedures, application forms and past papers etc. can be found on the HKSS website at www.hkss.org.hk.

Remarks

I am glad to report that the Examination Project is in smooth progress. You will no doubt appreciate that this endeavour is an important long-term development of the Society. The Project Team would like to take this opportunity to extend sincere thanks to all the persons who had rendered their assistance to the above developments/events, and look forward to your continued support to make the project a great success.

Annex

Results of the 2002 Round of HKSS Professional Statistical Examination

The following list of candidates had successfully completed the Ordinary Certificate (OC) / Higher Certificate (HC) / Graduate Diploma (GD) level of the HKSS Examination, and had been awarded the respective Certificates in October 2002. Congratulations to all of them !

	Name	*Level*	*Results*
1.	Miss CHAN HO YING	OC	PASS with DISTINCTION
2.	Miss CHAN KAM WAN	OC	PASS with CREDIT
3.	Mr CHAN KWONG YEUNG	OC	PASS
4.	Miss KO HAY NGAR HARRIET	OC	PASS
5.	Mr KONG WAI PAU	OC	PASS
6.	Mr KWONG KA SHI	OC	PASS with CREDIT
7.	Mr LEE TIT SHING	OC	PASS
8.	Mr TSUNG PO SHAN	OC	PASS
9.	Ms CHIU YUK SIM	HC	PASS
10.	Mr HA LIN TAT	HC	PASS with DISTINCTION
11.	Mr KWOK PING HUNG	GD	PASS
12.	Mr WONG KING TAI	GD	PASS

HKSS Seafood Boat Trip to Tung Ping Chau and Kat O

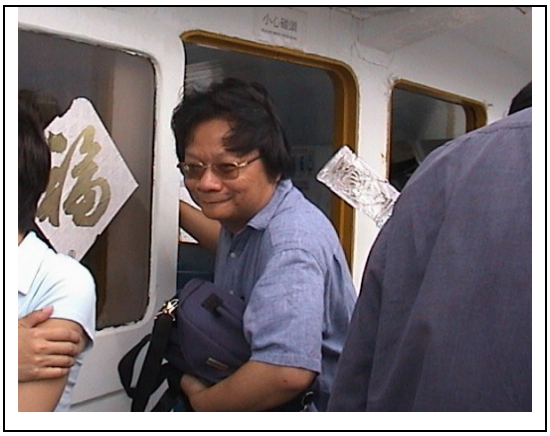
C. N. Lo
Programme Secretary

On the Mid-Autumn Festival 21 September 2002 (Saturday), the HKSS organized a sea boat trip to Ap Chau, Kat O, and Tung Ping Chau for members of the Society, and enjoyed a seafood lunch at Kat O. The response to the boat trip was good. There were members who brought along with their family members, colleagues, friends and even visitors from the Mainland China and Germany. The total head count for this trip was 49.

At 8:00 a.m, we assembled at the Chinese University KCR Station. The trip started at 8:30am to Ma Liu Shui harbour and there we took a ferry to Kat O. Before we arrived at Kat O at 10:30am, we had rounded the island Ap Chau twice and the tour guide had introduced the history of the island. At the Kat O, we visited a Tin Hau Temple and then took our seafood lunch near Kat O habour.

At 12:30pm, we continued with our boat trip to our final destination at Tung Ping Chau. The good sceneries around Tung Ping Chau especially, the sea, geographical cliffs, sunset and sunrise are very attractive. How enjoy it is for anyone to experience and see the beauty of the sea, the cliffs, the sunset and the sunrise at Kang Lau Shek (Watch-Tower Rock). It is located at the top of the most eastern part of Hong Kong. Next time, if we can go for a two-day trip, we can definitely have time to see all these in addition we can experience the diving and can have a chance to see the coral in the sea.

At 2:30pm, we left Tung Ping Chau. The tour ended in Ma Liu Shui around 5:00pm.



Members and non-members both really hope that there would be more and more outdoor activities coming soon. They can discover and all enjoy more charming natural environment in HK.

News

A Workshop on Financial and Economic Statistics to celebrate the Silver Jubilee Anniversary of the Society

To celebrate the 25th Anniversary of our Society, the Hong Kong Institute for Monetary Research (HKIMR) and the Hong Kong Statistical Society (HKSS) will co-organize a half-day workshop on Feb 15, 2003. The title of the Workshop is "Joint HKSS-HKIMR Workshop on Financial and Economic Statistics". It is our great honour to have invited four renowned speakers, who are all experts in the area of financial and economic statistics, to come and give a speech at this Workshop:

Prof. Ngai-hang CHAN, Director, Risk Management Science Program, The Chinese University of Hong Kong

Mr. Frederick W. H. HO, Commissioner of the Census and Statistics Department, HKSAR

Prof. Kin LAM, Chair, Department of Finance and Decision Sciences Hong Kong Baptist University

Mr. Roger K-H. LUK, Managing Director and Deputy Chief Executive, Hang Seng Bank

We have also invited Mr. King Cheong WU (Executive Director, Lee Cheong Gold Dealers Ltd.) as our honourable guest who will present an opening speech for this Workshop.

To appreciate your continuous support throughout the years, we are happy to announce that members of the HKSS can join the Workshop free of charge. To register for the Workshop, members of the HKSS will receive invitation letter and reply form when the details of the activity are finalized.