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金朝亮　编注

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前　言

当今世界，科学技术日新月异，知识经济已露端倪。信息技术特别是微电子技术突飞猛进，几乎渗透到社会的各个领域，成为最有活力、最引人注目的新兴学科。生物技术特别是基因工程蓬勃发展，人工定向地组建有特定遗传性状的生物体，为解决人类所面临的资源与能源、环境与污染、健康与疾病、食品与营养等问题开辟新的途径。空间技术特别是星际航行阔步前进，标志着人类的活动已经超越地球的范围，开始跨入向太空进军的新时代。

为了帮助我国大学英语学习者及时了解现代科学技术发展的动态，提高科技英语阅读能力和写作能力，我们从国外多种优秀英语科学杂志中精选了一百多篇文章，汇集成册。这些材料不仅内容新颖、学科面广，而且语言规范、文字流畅，十分适合广大高校学生及有关科技英语爱好者阅读。

在本书编写过程中，金林、吴敏婕为文章的录入和编排付出了辛勤的劳动，在此表示诚挚的谢意。

编者

2002 年 11 月　上海

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Scene saver

Digitally remastering old films will save classic movies from oblivion

MORE than two million films languish in vaults① around the world, some of them so badly damaged they can no longer be screened. If nothing is done, they could disappear for good②, like half the films made in the US before 1950. But research at the University of La Rochelle in France and the Monash University in Clayton, Victoria, promises an automated technique to restore these old films to their former glory.

Films can be cleaned chemically or by using ultrasound. But this is time-consuming and expensive, and chemicals can also damage the original. Another approach is to digitize the film and then clean up the digital version frame by frame③—a daunting job. When Disney cleaned up *Snow White* for release on DVD, for instance, graphic artists④ worked in shifts⑤ on 40 computers day and night for 18 weeks.

These computer-aided techniques remain very expensive, says Samia Boukir, who started work on an automated system in La Rochelle but has now moved to Monash. Only an automated system can hope to salvage the archive⑥ of deteriorating films.

Once a film has been scanned in, the first stage of the process is to correct flicker⑦ caused by the film slipping—the result of damage to its perforations⑧. The software picks out distinct features in a pair of frames, such as prominent pieces of background, and measures

movement of the features between the frames. It then moves on to the next pair of frames and again notes the difference. Using this information, the system works out if two frames are unusually close together or far apart, and corrects any anomalies[9].

Dust spots usually occur only on single frames, so the system looks for small specks[10] that are visible on one frame and absent on its neighbours. The software repairs the image by sampling the unspoilt area of the image on the adjacent[11] frames and replacing the dust spot with an average of the sampled pixels[12].

Detecting scratches[13] is more complicated because they may run over several frames and can be confused with vertical lines that are part of the film. But a telltale pattern often gives them away: scratches are normally caused by the mechanical parts of a projector[14] rubbing on the film, so they tend to repeat at regular intervals.

The system looks for a periodic pattern of this type from frame to frame, predicting when it should occur in the subsequent frames. When the scratch finishes, the pattern breaks down. Having identified the scratch and its duration, the software then repairs the damage by taking pixels from undamaged frames before and after the scratch. This smoothing effect avoids any sharp edges in the restored image, says Boukir. Finally, film grain is added back.

When detecting dust particles, says Boukir, 95 per cent accuracy is acceptable. But with line scratches it has to be better. "The removal of significant scene details would have disastrous consequential effects on the resulting restored movie," she explains. Because of this, some level of human intervention will be needed, but it is likely to be little more than an operator

accepting or rejecting a change.

Boukir says that instead of trying to enhance the whole image on a frame, it is better to concentrate on repairing damage. "For good preservation of texture[15], it is necessary to look beyond the use of existing global filters, which are applied to the entire image," she says.

Once restored, the digitised films can be viewed by future generations without risking more damage to the original by running it through a projector. And films are very vulnerable[16]. "Film has a hundred-year history, but the knowledge of how to store it properly is only 15 years old," says Godfrey Pye of Sunset Digital, a Hollywood-based company that specialises in cleaning up old movies.

Duncan Graham-Rowe and Barry Fox

Notes:

① languish in vaults /ˈlæŋgwɪʃ ɪn vɔːlts/ **堆积在仓库里**
② for good **永远地**
③ frame by frame **一个镜头一个镜头地**
④ graphic artists **平面造型艺术家**
⑤ in shifts **轮班**
⑥ salvage the archive /ˈsælvɪdʒ ðɪ ˈɑːkaɪv/ **抢救档案资料**
⑦ flicker /ˈflɪkə/ **图像抖动**
⑧ perforation /ˌpɜːfəˈreɪʃən/ **胶片齿孔**
⑨ anomaly /əˈnɒməlɪ/ **异常**
⑩ speck /spek/ **霉斑**
⑪ adjacent /əˈdʒeɪsənt/ **邻近的**
⑫ pixel /ˈpɪksəl/ **像素**
⑬ scratch /ˈskrætʃ/ **刮痕**
⑭ projector /prəˈdʒektə/ **放映机**
⑮ texture /ˈtekstʃə/ **质感**
⑯ vulnerable /ˈvʌlnərəbl/ **容易损坏的**

Digitise this

The most secure biometric e-signatures

OVER COFFEE, you sign off on $5 million business deal. By lunch, you've had a prescription① filled and sold your condo② in Colorado. All this without leaving the comfort of your ergonomically③ designed chair. Impossible? Not after this October 1, when the Electronic Signatures Act makes e-signatures that can be used over the Internet legally binding. Now all you have to worry about are digital forgeries④.

Fortunately, there's a solution to the threat of electronic forgeries and tampering⑤: digitally capturing the physical act of signing. The key is biometrics⑥—the statistical analysis of biological data.

To safely sign an electronic document using biometrics, you sign your name in the usual way, but with a special pen that measures the movement and force of your hand and transmits this data to your computer. The resulting biometric data is then mathematically bound to your electronic signature, which is in turn mathematically bound to a specific document before electronic transmission. Any attempt to change the e-signature or copy it onto another document, without the information on the file to which it has been bound, will be detected by the recipient⑦.

Such captured signatures⑧ turn out to be the most secure technology precisely because handwriting is so imprecise. Fingerprints, which don't change, can be forged with rubber stamps⑨, and retinal scans⑩ often

fail because the eye can change, as the shape of the retina does during pregnancy, for example. But biometric handwriting security depends on a lack of consistency. Because no one ever signs exactly the same way twice, a perfect match to a signature is a guaranteed forgery. To provide this second level of security, most handwriting-recognition systems require that you input a number of different signatures.

Two of the hottest biometric e-signature products currently available are PenOp's Signature Series software, used by Congress to sign the Y2K bill[11], and this year's winner of Europe's IT Grand Prize[12] for new technology products, LCI's Smartpen. The PenOp software, available for $99 per computer, records your biometric data and signature via[13] an electronic pad attached to[14] the computer. For mobile e-merchants, $150 buys LCI's wireless Smartpen, which uses Bluetooth short-range radio technology to transmit signatures and data to a Bluetooth-equipped PC. If, however, electronic signatures make you uneasy, you can still use the Smartpen to sign your checks the old-fashioned way—using its standard ballpoint tip.

Kathryn Leonard

Notes:

① prescription /prɪˈskrɪpʃən/**协议书**
② condo /ˈkɒndəʊ/**公寓套房**
③ ergonomically /ˌɜːgəˈnɒmɪklɪ/**能发挥最大功效**
④ forgery /ˈfɔːdʒərɪ/**冒充**
⑤ tampering /ˈtæmpərɪŋ/**涂改**
⑥ biometrics /ˌbaɪəʊˈmetrɪks/**生物统计学**
⑦ recipient /rɪˈsɪpɪənt/**受件人**
⑧ captured signatures **存档签名**
⑨ forged with rubber stamps **用橡皮图章仿造**

⑩ retinal scan /ˈretɪnəl skæn/**虹膜扫描**
⑪ the Y2K bill **千年虫法案**
⑫ IT Grand Prize **信息技术新产品大奖**
⑬ via /ˈvaɪə/**通过**
⑭ attached to **连接到**

Big audio dynamite

If you play pirate CDs, you could end up trashing your hi-fi

CD pirates① beware—the music industry has a new weapon up its sleeve②. It's called the Cactus Data Shield, and it is designed to add noisy garbage to all copied CDs. Trouble is, it could also damage the hi-fi③ and loudspeakers of people who play pirated CDs.

Sony is already evaluating④ the Cactus system through its music division, which has been secretly testing it in Eastern Europe. The system was developed by Midbar Tech (www. midbartech. com), a company based in Tel Aviv. Midbar Tech refuses to comment on how its system works, but *New Scientist* has dug out its American patent⑤ (US 6208598)—which reveals all.

Midbar's anti-piracy technology follows on the heels of⑥ a similar system from Macrovision of California, which recently launched its SafeAudio system (*New Scientist*, 14 July 2001, p. 22). This adds uncorrectable errors to the digital music on a CD, so CD writers on PCs can't copy it. But Macrovision admits SafeAudio doesn't work with consumer disc-to-disc CD copiers.

However, Eyal Shavit of Midbar Tech claims, "We can stop all kinds of copying, even on domestic CD recorders."

Midbar's patent points out that all music CDs store bursts of music code and control information. The music data is marked with "flags" which tell the CD player to

decode it and send it to the amplifier and loudspeakers. The control information is not decoded. When burning the original CD, Midbar's idea is to replace some of the music with false data and label it as control information. While CD players do not decode this, they are designed to disguise the gap⑦ by bridging it with guessed data. So the original CD plays acceptably, according to Midbar.

"There is little or no net difference in audio quality," it claims in its patent, though the company will not identify the "golden-eared" listeners who have tested the system.

If the CD is copied, however, the copier machine (PC or disc-to-disc copier) sees the fake control data as music. So when the copied disc is played, there are bursts of distortion⑧ as the player tries in vain to decode the garbage. It not only sounds bad, says Midbar, but it is "potentially damaging" to the player's circuitry⑨ if the added noise has a suitable wave shape.

It is well known in the audio industry that feeding large "square wave" pulses to sensitive circuitry—particularly loudspeakers—can cause damage because high-frequency harmonics⑩ in the steeply rising and trailing edges⑪ cause rapidly repeating high-energy peaks in the speaker output.

Sony has secretly tested Cactus by treating several thousand CDs sold recently in the Czech Republic and Slovakia, but the system was not set to cause damage on this occasion. "We have had no problems with loudspeakers," Savit says. While acknowledging that it may seem "unacceptable" to harm consumers' equipment deliberately, he adds, "It's 'sweat engineering'. We can add extra lines of defence as

people use new attacks."

Midbar will not identify the affected CD titles sold in Eastern Europe, so no independent listening tests are possible.

Barry Fox

Notes:

① CD pirate /ˈpaɪərət/**激光唱片盗版者**
② has a new weapon up its sleeve **自有招术**
③ hi-fi **音响**
④ evaluate **评估**
⑤ patent /ˈpeɪtnt/**专利**
⑥ on the heels of **紧跟其后**
⑦ disguise /dɪsˈgaɪz/ the gap **填补空白**
⑧ distortion /dɪˈstɔːʃən/**杂音**
⑨ player's circuitry /ˈsɜːkɪtrɪ/**唱机的电路元件**
⑩ harmonics /hɑːˈmɒnɪks/**泛音**
⑪ trailing /ˈtreɪlɪŋ/ edges **脉冲后沿**

Off key

Wouldn't you be angry if CDs refused to play on your PC?

IF you like listening to music CDs while working on your computer, *New Scientist* has some bad news: a company has found a way of preventing CDs being played on a computer's CD-ROM drive. The idea is not to increase productivity in the office, but to stop pirates copying① CDs or sending CD-sourced music across the Internet. It is not yet clear, however, whether record companies will risk consumers' wrath② by releasing discs they can't play on their PCs.

Software companies, including Microsoft and IBM-owned Lotus, already use C-Dilla's SafeDisc system to stop people copying CD-ROM data discs. SafeDisc puts the program material in an encrypted③"wrapper" which can only be unwrapped when a digital signature code pressed into the disc matches an authorisation code entered into the PC. While a ROM drive can read the authorisation code, a CD recorder cannot copy it, so copies of the CD-ROM will not run.

A CD-ROM disc stores data at three levels, and although a CD-ROM drive reads all three, it only passes the top level into a PC for copying. SafeDisc stores the key code signature at a lower level, so it can be read from the original CD-ROM disc but not copied onto a blank. Although a CD recorder can copy a protected disc, the copy will not run on a PC even when the correct authorisation code is entered.