Mathematics In The Real World

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Abstract

Mathematics is a versatile tool with great potential for applications. Mathematics is the Queen of all sciences. Mathematics plays a vital role in our daily life. In today's world almost all the discoveries and facts are related to it. Every great scientific discovery was preceded by a corresponding breakthrough in Mathematics.

Mathematics has applications in almost all the fields including Physics, Engineering, Finance and many other fields. It is rapidly gaining popularity and recognition with applications ranging from pure mathematics to virtually every field of engineering, from astrology to economics and from oceanography to seismology. Math provides good organizational skills, logical and clear thinking and increases the problem solving ability.

Keywords: *Mathematics, real world problems, Science and Technology, learning*

I. INTRODUCTION

Mathematics is important in our everyday life, allowing us to make sense of the world around us and to manage our lives. Using mathematics enables us to model real-life situations and make connections and informed predictions. It equips us with the skills we need to interpret and analyse information, simplify and solve problems, assess risk and make informed decisions.

Mathematics plays an important role in areas such as science or technologies, and is vital to research and development in fields such as engineering, computing science, medicine and finance. Learning mathematics gives children and young people access to the wider curriculum and the opportunity to pursue further studies and interests.

Because mathematics is rich and stimulating, it engages and fascinates learners of all ages, interests and abilities. Learning mathematics develops logical reasoning, analysis, problem-solving skills, creativity and the ability to think in abstract ways. It uses a universal language of numbers and symbols which allows us to communicate ideas in a concise, unambiguous and rigorous way.

Mathematics equips us with many of the skills required for life, learning and work. Understanding the part that mathematics plays in almost all aspects of life is crucial. This reinforces the need for mathematics to play an integral part in lifelong learning and be appreciated for the richness it brings.

Career in Mathematics

All quantitative disciplines need Mathematics

- Physical sciences: physics, physical chemistry, bio-physics, engineering (all varieties), geo-physics (geo-statistics), biomechanics, computing science, Software Engineers, Database Managers, ….
- Business: economics, finance, actuarial studies, management. Financial Analyst, Risk Analyst, Insurance, Investment Banking, Economics

  and Commerce, Software Engineers, Database Manangement

- Biological sciences: bio-statistics, bio-informatics, bio-metrics, psychological measurement, medical statistics, medical imaging, medical engineering, exercise science, bio-mechanics, ecology, social statistics.

II. IMPORTANCE of MATHEMATICS

Some degrees lead to obvious careers. Study medicine, and you become a doctor. Gain a law degree, and you're well on the way to becoming a lawyer. There are actually no 'typical jobs' for maths graduates. Maths is more of a way of thinking than training for a particular profession. However, a mathematician's logical, problem solving and numerical skills are highly sought after.

Actuarial services

Actuaries use maths and statistics to make financial sense of the future. For example, if an organisation is planning a large project, actuaries analyse the project, assess the financial risks and outcomes involved, and advise the organisation on the decisions to be made. Much of their work is on pensions, ensuring funds have enough money for when current workers retire. They also work in insurance, making sure that premiums match the level of risk.

Economics

Much of the government's economic policy is based on analysis and predictions made by mathematicians. Large companies also use statisticians to analyse markets and assess risk. Financial institutions in the City employ large numbers of maths graduates for financial modelling and stock market trading.

Scientific research

Pharmaceutical companies employ teams of mathematicians to work with clinical data on the effectiveness or dangers of new medicines. Pure scientific research in chemistry and biology also needs mathematicians to help develop models of complicated natural processes.

Teaching

Mathematicians can find jobs at all levels of the education system. To teach in a school, you need to take the Postgraduate Certificate in Education (PGCE) after doing your degree. If you want to become a university lecturer, you usually need to have a PhD and be doing active research.

Alternative careers

People with maths degrees go on to do all sorts of things! Alternative careers tend to involve a different style of work, such as freelancing or working from home, or a different type of job - eg with a voluntary or ethical organisation.

Ethical employers such as charities and rehabilitation centres, or environmental and humanitarian organisations like Greenpeace and Amnesty International are less profit-motivated. Even though these organisations aren't driven by profit, they still need mathematicians to perform statistical analysis and keep them within their budgets.

There are also opportunities for numerate and logically minded mathematicians who have the ability to communicate technical ideas clearly.

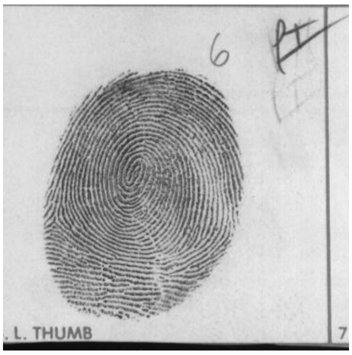
III. MATHEMATICS IN SCIENCE AND TECHNOLOGY

A. IMAGE PROCESSING

Mathematical image processing techniques make it possible for us to capture, transmit and store photographs and video. They also let us restore noisy or damaged images and extract useful information from visual data. For different applications we can refer to [7].

Image processing began in the 1960s with the development of an algorithm called the "Fast Fourier transform" (FFT). The Fourier transform is a 200 year old mathematical operation for splitting a signal into distinct parts that can be processed separately. The Fourier transform works well for images with smooth, curved features, but is less suitable for straight edges and right angles. These features are better handled by alternative approaches such as the wavelet decomposition, which is used to store and transmit the billions of JPEG images on the internet and was developed in the 1980. FBI use mathematics as a tool to store the data of 30,000 million fingerprints.

Image Compression



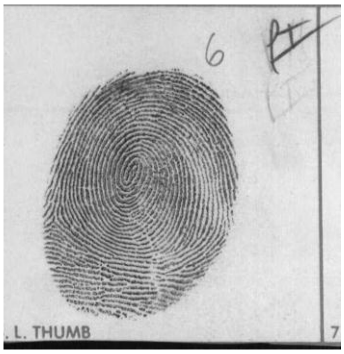


Fig. 1 Original image 541832 bites 768x768 Reconstructed image (compressed file size 32702, compressed ratio 18:1)

B. WEATHER FORECASTING

Increasing global temperatures, rising sea levels and the disruption of fragile ecosystems: climate change is one of the greatest challenges humanity has ever faced, and could potentially affect billions of lives in the coming century.

Scientists around the world are working to tackle the problem with detailed models of our changing climate, and mathematicians are at the heart of these models, solving the difficult equations that no one else can. Researchers in meteorology, physics, geography and a host of other fields all contribute their expertise, but mathematics is the unifying language that enables this diverse group of people to implement their ideas in climate models[5,7]. The secrets of the climate system are locked away in the Navier-Stokes equations.

The Navier-Stokes equations were first derived by the French physicist Claude-Louis Navier in 1822, but later developed independently by the British mathematician George Stokes in 1845, who wrote the equations in the form still used today. The equations are derived from Newton's second law of motion, force equals mass times acceleration, and describe the relationship between the velocity, pressure, viscosity and density of a moving fluid. As a linked set of four nonlinear partial differential equations the Navier-Stokes equations are impossible to solve analytically in all but a few trivial cases, hence the need for numerical approximation methods such as those developed by Paul Williams. These methods allow us to apply the Navier-Stokes equations to a range of practical situations.

C. MEDICAL IMAGING

Medical imaging techniques let us peer inside the human mind, furthering our understanding of how the brain works and offering the possibility of combating devastating conditions such as Alzheimer's disease and schizophrenia. Mathematical research is at the heart of these techniques, working together with technological advancement to create enormous benefits for society. For example, we refer to[8].

Mathematicians study inverse problems in a wide variety of contexts besides brain imaging, such as radar detection, weather prediction, and facial recognition. Solving the inverse problem of determining internal brain activity from external magnetic or radioactive signals could only have been achieved with advanced mathematics. In the case of MEG, the magnetic field outside of the head can be written as an integral equation involving the neural current inside the brain, but inverting this integral is far from simple. The equation shows that the radial component of the neural current has no effect on the resulting magnetic field, which means that current levels at different points within the brain can produce the same magnetic field.

Thanasis Fokas[2,3] and colleagues realised that representing the neural current in appropriate coordinates allowed them to identify certain parts of the current that could be uniquely identified by the magnetic field, provided that the current also fulfilled certain requirements. Without the use of sophisticated mathematics, MEG and other brain scanning techniques would simply not be possible.

D. SMART PHONES

There are more active mobile phones in the India than people: The mobile communications industry is only made possible by the mathematical study of signal processing, which allows us to extract useful information from the noisy, invisible sea of radio signals above our heads. The rise of smart phones and mobile internet will introduce new challenges to the mobile networks, but cutting-edge mathematics is set to provide cheaper, more energy efficient and better quality communications for all.

Mobile networks, like all forms of communication, are underpinned by a branch of mathematics called information theory[1,4,6]. It was founded in the late 1940s by the American mathematician Claude Shannon, who realised there is an upper limit on the amount of information that you can send over a communications channel, such as a radio frequency band, before errors start to creep in. Reaching this "Shannon limit" requires a mathematical description of the message called an error-correcting code, but for decades the best codes could only achieve around half-capacity.

These improvements exploit an important new development in broadcasting technology called MIMO, or "multiple input and multiple-output". MIMO uses arrays of "smart" radio antennas in both the transmitter and receiver , combined with software that tunes in on the direction in which a signal is strongest. The process is similar to tuning an FM radio into your favourite station, but rather than twiddling the radio dial, a mathematical algorithm rapidly tries different array configurations until it finds the best signal.

E. LEARNING OF MATHEMATICS

"The great book of nature can be read only by those who know the language in which it was written and that language is mathematics" **Galelio**

It is necessary for people to study Mathematics for many reasons. The universal language of the world is math, and people have been using it for thousands of years across the world. Today's society would not be in existence without the application of mathematics.

The application of math can be seen everywhere throughout the world, and without it a majority of things would not be possible. Complicated things such as building a bridge, flying an airplane, or mass producing anything would not be possible. Even if someone has no interest in maths, to live in today's society it is necessary for someone to be able to support themselves financially, and money involves math. In order to cook numerous things exact measurements and temperatures, as well as exact times are needed, all involving math.

It is also important to study mathematics because it gives one a different perspective on things. Learning math involves a different type of thinking that is not addressed in other subjects. To be a well educated person one need to be able to think methodically and analytically as well as figuratively. People most commonly state that math is hard and they will never need to use math in their majors. However, just as it is necessary for engineering and math based majors to take philosophical courses, other majors not pertaining to math, still need to take math courses in order to be well rounded students. Even if math is hard for someone, and they need to persistently work at it to understand it, it will create a good work ethic for them. Math teaches people to recognize patterns in everyday things, and view things more critically.

Whether people like math or not, in order to be a part of today's society one needs to understand the concepts of mathematics. It is essential for mathematics to be integrated into the school curriculum so people have a better understanding of math in the world today.

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