SPE Review London May 2023

SPE Review London

The official e-magazine of the Society of Petroleum Engineers' London branch

London Section

Machine learning guide: Part 1

Also in this issue:

- C-Level talks: Barny Brennan
- Energy transition, digitilisation and networking
- Graduating SPE student members' offer
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SPE SECTION EXCELLENCE *** AWARD *** 2020

50 YEARS

LETTER FROM THE EDITOR and SPE LONDON CHAIR

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ABOUT US

The Society of Petroleum Engineers (SPE) is a not-for-profit professional association whose members are engaged in energy resources, development and production. SPE is a non-profit professional society with more than 156,000 members in 154 countries, who participate in 203 sections and 383 student chapters. SPE's membership includes 72,000 student members. SPE is a key resource for technical knowledge related to the oil and gas exploration and production industry and provides services through its global events, publications, events, training courses and online resources at www.spe.org. SPE London section publishes SPE Review London, an online newsletter, 10 times a year, which is digitally sent to its 3000+ members. If you have read this issue and would like to join the SPE and receive your own copy of SPE Review London, as well as many other benefits – or you know a friend or colleague who would like to join – please visit www.spe.org for an application form.

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SPE encourages open and objective discussion of technical and professional subjects pertinent to the interests of the Society in its publications. Society publications shall contain no judgmental remarks or opinions as to the technical competence, personal character, or motivations of any individual, company, or group. Any material which, in the publisher's opinion, does not meet the standards for objectivity, pertinence, and professional tone will be returned to the contributor with a request for revision before publication.

SPE SECTION EXCELLENCE *** AWARD *** 2020

In this issue

FEATURES

Photo by Grant Durr on Unsplash

Behind the Scenes: SPE Review Editorial Board

Elizaveta Poliakova, Editor in Chief

Elizaveta is a Reservoir Engineer at Trident Energy. She has an M.Sc in Petroleum Engineering from Imperial College London and a B.S. in Petroleum Engineering from the University of Leeds.

Elizaveta has been with SPE for more than seven years. She was the President of SPE Imperial College Chapter and the President of SPE Leeds Chapter. Previously, she was also on the committee of SPE YP.

Ffion Llwyd-Jones

Ffion is a business editor and writer. She has extensive experience in writing and editing (digital and print), with international experience in technology, health, automotive and the environment.

Mark Beleski

Mark is an experienced engineer, with deep understanding of industry practices, trends and challenges. He is an Energy Loss Adjuster with AqualisBraemar, in London.

Shalom Amakhabi, Editorial volunteer

Shalom is a graduate gas transmission engineer with National Grid Gas Transmission and metering. She has an MSc in Petroleum Engineering from Imperial College London and a BEng in Petroleum and gas engineering from the Nile University of Nigeria. She has been an SPE member for 5+ years.

A big Thank You! to all the organisations supporting the SPE London section

Letter from the Editor and SPE London Chair

Dear SPE London Members and colleagues,

Welcome to the second edition of SPE London Review in 2023. This publication is dedicated to exploring further the topic of energy transition and machine learning applications in the energy sector. On behalf of the SPE London Editorial Team, I hope you enjoy reading it!

In this publication, on page 9, we featured an insightful C-Level Talk by Barny Brennan, an independent consultant and SPE London Net Zero Gaia Chair. His talk offers valuable insights into the necessity for professionals in our industry to be open to and willing to change.

On pages 11 and 26, you will find an update from the SPE Imperial College and SPE Portsmouth Student Chapters respectively. It is heartening to see the dedication and passion of the next generation of petroleum engineers.

Page 14 features a guide on machine learning for petroleum engineering professionals, written by Saif Ur Rehman. This is a must-read for anyone looking to understand ML within the industry. Please make sure you have a pencil and paper handy to take notes!

Last but not least, page 29 features a summary of local and international events. Make sure to check it out to stay up-to-date on the latest happenings in the industry.

As always, we welcome your feedback and suggestions for future editions of the SPE London Review. Thank you for your support.

A separate thank you to our Editorial Team for the continuous hard work!

Sincerely yours,
Elizaveta

NEWS DIGEST... NEWS DIGEST... NEWS DIGEST

Commitment to net zero by 2040

With an investment of £55 million over the next 10 years, the Port of Aberdeen plans to become the UK's first net zero port by 2040, according to its announcement on 28 April.

Bob Sanguinetti, Chief Executive, Port of Aberdeen, said: "Today we launched our net zero strategy with the aim of becoming the UK's first net zero port by 2040. Strong partnerships and investment across the public and private sectors are essential to deliver this transformational change which will deliver significant benefits for the environment, local communities, and wider maritime sector."

Read more

Improved prospects?

BP has expanded its holding in Australia's Browse joint venture by agreeing to buy rival giant Shell's 27% stake.

The move in Australia's largest untapped gas resources could lead to improved development prospects for the project.

If the deal goes ahead, BP's take in Browse will increase to 44%.

Other stakeholders in the North West Shelf LNG plant include Woodside and Shell.

"BP believes development of the Browse gas resources could make a significant contribution to energy security in Australia and to the Asia Pacific region," a BP spokesperson said.

Neither Shell not BP offered any comment on the deal price.

Read more

Oil (Brent) 79.40 -0.93 (-1.16%) – 01/05/2023 (**Credit: Market Insider**)

Supporting energy independence

The 11th production well at the Cygnus natural gas field in the UK's southern North Sea is on stream by partners Spirit Energy and Neptune Energy.

The field output will subsequently increase by a further 4,000 barrels of oil equivalent per day.

According to Neptune Energy's UK country director, Alan Muirhead, the field has capacity "to supply around 6% of the country's gas demand".

He said: "We're taking steps to boost North Sea gas production, which reduces the UK's reliance on less secure and more carbon intensive supplies of imported energy, and also supports the government's aim of achieving energy independence by 2040."

Spirit Energy chief executive Neil McCulloch added: "Continuing to secure reliable and responsible supplies of energy from the UK continental shelf has never been more important."

Neptune Energy chief executive Pete Jones. Photo: NEPTUNE ENERGY

Read more

NEWS DIGEST... NEWS DIGEST... NEWS DIGEST

SPE Policy on AI-Generated Content in Publications

The SPE Board has approved a new policy allowing AI-generated content to be used within SPE publications but under specific conditions.

AI-assisted language tools (such as ChatGPT) have gained widespread attention recently, particularly for their capability to assist in drafting scientific papers. While these tools have the potential to enhance the efficiency and speed of academic and technical writing, the ethics and best practices for their use are still evolving. These tools may generate useful information and content but are also prone to errors and inconsistencies.

The SPE Board has approved a new policy for authors who use AI language tools to generate content for their papers. The policy states that AI- generated content may be used within SPE publications but under specific conditions.

- AI language tools may not be listed as an author. The AI tool cannot sign publishing agreements or transfers of copyright.
- Any AI-generated content that is used within a manuscript should be thoroughly vetted, fact checked, and disclosed.
- If AI language tools are used within a manuscript, their use should be clearly explained within the methodology or acknowledgment section of the paper. If AI-generated content is included within a manuscript without an explanation, this can be grounds for rejection of the work at the discretion of SPE and may result in a code of conduct review.
- The authors of the manuscript will be held responsible for any errors, inconsistencies, incorrect references, plagiarism, or misleading content included from the AI tool.

It is important to note that technology for AI language tools is advancing rapidly. SPE plans to periodically review and update this policy to ensure its relevance and effectiveness. Any modifications to the policy will be communicated transparently and in a timely manner.

Userba011d64_201/Getty Images/iStockphoto

Finding solutions to navigating the energy transition – and having fun

Barny Brennan is an independent consultant and the SPE London Net Zero Gaia Chair. He believes it is critical for the oil and gas industry to embrace the changes to our energy landscape.

Barny has 34 years of technical and management experience. With a geoscience background, he is keen to explore steps to reduce the carbon intensity of oil and gas developments, as well as investigating options for integrating with other sectors of the energy industry. He sees the SPE having a key role in helping members navigate the energy transition through initiatives such as those being set up by the London Net Zero Committee.

Who is Barny Brennan? Please tell us about yourself.

I am a Geoscientist by background, and I guess I have always been interested in the world around me, particularly the natural world, and trying to understand how it works. As a kid, I would be picking up stones on family walks, trying to persuade members of the family to help carry them home. The differences in those stones interested me but it was only later, with a bit more geological education, that I realised those differences could be used to help unravel the story of how the earth works.

I studied Mining Geology at Leicester University, and it was partly by chance (and frankly because that was where the best jobs were) that I ended up in the oil and gas industry, joining Scott Pickford in 1985. That was at a time when computers were being introduced to the industry and my first job was to digitise interpretation of seismic sections – laborious work but we had a lot of fun away from the work itself!

I moved to Phillips Petroleum in 1988, where I worked with, and learned from, so many excellent people. It was a really supportive and collaborative environment, and more than thirty years later we still meet up regularly, sharing stories from various field trips and wayward adventures.

I took a break from the industry in 1990 to spend a year travelling independently through Africa from Morocco down to Zimbabwe, before re-joining Phillips for another 11 years.

I have always enjoyed running and in my early years was intensely competitive, channelling as much energy into that as my career. After returning from Africa, and as my running speed dwindled with age, career and family became increasingly important and I now have two fantastic grown-up kids with my wonderful wife Gill, and have enjoyed a very interesting career.

After Phillips, I joined Production Geoscience Limited (PGL) and ran their Guildford office. Life in a small consultancy, with all its variety, really appealed to me. I loved the way the company was run, and the interactions within the organisation made it feel like a family. One progressive idea of PGL's was to have a staff elected director on the board and I am proud that I filled that role for two years running.

And then?

I left PGL not long after its merger with Senergy and joined a small independent operator, Xcite Energy Resources. They were a small entrepreneurial company, who had recently gained a license for, and drilled an appraisal well on, the Bentley heavy oil field in the North Sea. Working for a small operator was exactly what I wanted as it gave an opportunity to influence strategic decisions while still maintaining and broadening my technical skills.

As Subsurface Director, it was my role to understand how the field worked, help to define and execute a further appraisal programme to prove our ideas, and to explain (to a sometimes-sceptical audience) how a heavy oil development could be made to work in an offshore setting. Integration between geoscience, reservoir engineering, wells and completion engineering, chemical and facilities engineering, and cost engineering, were absolutely critical to this and I am a firm believer in minimising barriers to working across these disciplines.

I was part of a restructuring of Xcite in 2017, who then started operating as Whalsay Energy, which eventually led to a successful company sale in 2020. Since 2020, I have been enjoying a variety of projects as an active independent consultant, while also pursuing voluntary work including the SPE Net Zero committee

At heart, I am still that kid picking up stones trying to

Finding solutions ... continued

figure out how things work. That is why I am so interested to hear from others and learn from their knowledge. I have been delighted that I can share some of that through the SPE London Net Zero webinar series that I now organise.

Where did your interest in Net Zero and the Energy Transition come about?

I think geoscientists are pretty good at looking at global scale systems and seeing today's environment in the context of millennia. I was, therefore, an early believer in what climate scientists were trying to communicate to us – that we were in a climate crisis, which has escalated to an emergency. However, like many of us, I suspect, I was relatively slow to adapt my own behaviours and outlook. It is probably only the last decade where I have recognised that we all need to take responsibility for the climate be it through personal choices or the work we do.

I don't believe that simply curtailing oil and gas production is the solution as that would have its own negative consequences to society, but as industry professionals we need to take responsibility for finding solutions that minimise emissions and speeds up the transition. And I do believe we are able to do that given the technical and operational skills within the industry along with its financial clout.

While at Whalsay Energy, recognising the need for oil and gas operations to minimise emissions, I investigated potential actions that could reduce the carbon intensity of the proposed Bentley development. These ranged from operational changes, to facilities design, to alternative production philosophies, and considered options to integrate with other sectors such as offshore wind.

I have carried forward that interest in decarbonisation to my work as an independent consultant, which began in 2020, and to my efforts with the SPE London Net Zero committee, which I have been doing since 2021.

As an independent consultant focussed on the energy transition, what do you consider the most important steps in reducing the carbon intensity of oil and gas developments?

The first thing is for oil and gas companies to have a willingness to engage in the conversation.

Fortunately – in the North Sea at least – I think this is no longer an issue, as those who don't join the conversation are likely to find themselves not meeting the requirements of their investors or the regulators and will be left behind. However, joining the conversation is insufficient without a willingness to change the way we do things.

Change will be driven through a combination of regulatory and other stakeholder pressures, and financial motivation (such as access to capital or avoiding possible future fiscal penalties for high emissions), and it will be enabled by deployment of technology, adoption of new techniques and procedures, and through collaboration across companies and sectors.

There is already a lot of technology that can reduce emissions from oil and gas operations, but we have been relatively slow to implement these. The industry takes a conservative approach to deployment of new technology, which is understandable given the potential human and financial costs of when things go wrong, but this can slow down the move towards net zero. Additional financial support to companies for proving the efficacy of new technology including the safety case would help.

As things stand, for existing developments there is often no financial incentive to implement the changes required to reduce emissions, especially if a field is towards the end of its life. The CapEx costs of reducing emissions, may exceed any operational cost savings. This can only really be addressed with changes to the fiscal regime to incentivise low carbon intensity production or to penalise high carbon intensity operations.

For existing developments, emissions reductions are most likely achieved through a series of incremental steps, focussing initially on methane reductions as a "quick win", but also on operational and equipment efficiencies. These, at least have a chance of delivering a positive return. For instance, as an industry we expend far too much energy and costs pumping around water – a focus on minimising water-cut will help both emissions and the bottom line.

The situation is easier for new developments, where the investment capital and regulatory approval can be contingent on meeting certain emissions criteria. From an engineering perspective, it is also far easier to engineer a low-emissions solution when starting from a clean slate. As a good case study, I encourage readers to look at Orcadian Energy's proposal for developing their Pilot field **https://orcadian.energy/esg/net-zero-basin/**.

Finding solutions ... continued

How do you see the possibility for future integration with other sectors of the energy industry?

This is a really interesting question as integration comes in many shapes and sizes.

The most obvious one is shared infrastructure, for instance utilising oil and gas pipelines, platforms and wells for carbon transport and storage, hydrogen, or geothermal. However, the devil is often in the detail – re-use engineering studies potentially revealing issues that prevent seamless integration.

Nevertheless, the attitude of asking the question "can we get more from what we already have?" is a good one. A non-oil and gas sector example of this would be the utilisation of heated groundwater from abandoned mine workings for onshore geothermal projects.

Beyond infrastructure (and potentially more beneficial in the long run) is the integration of ideas, technology and skills. Each sector has its own experts and ways of doing things that to a lesser or greater extent has been successful until now. However, to really deliver the energy transition at the pace we need, there must be a step change in the way we do things. The cross fertilisation of ideas and technology between sectors could be the catalyst for this. An openness of dialogue is needed, encouraged by leaders with collaborative mindsets. The oil and gas sector should be careful not to come across as "We are the big guys. We have all the answers!". We don't! We can and must learn from others.

As Net Zero Gaia chair, how do you believe SPE can help its members navigate the energy transition through initiatives such as those set up by the London Net Zero Committee?

There are two parts to this, both of which are consistent with SPE goals and objectives.

The first is around education and skills. We do this through our monthly webinar series, where each month we will tackle a different aspect of the energy transition that can take us to a net zero world. Subjects might be specific to oil and gas, such as offshore electrification of oil and gas production, or they could relate to other parts of the energy sector, such as carbon capture, geothermal or hydrogen. By improving our understanding of these subjects, we can potentially help cross fertilise ideas, recognise our transferable skills and gain a better understanding of new skills we might need in the future. This webinar series has proved very popular, sustaining high attendance throughout the pandemic and since. Recordings of our back catalogue can be found here **https://www.spe-london.org/spe-net-zero-virtual-programme/**.

The second part is around connections and networking. Our Sustainable Careers initiative, led by Alison Isherwood, profiled the journeys of individuals navigating the transition. This enabled us to think about our own journeys particularly relating to evolving education opportunities, recruitment trends and career pathways. Getting people together in the physical world through networking events, so they can share their stories and ideas about the energy transition is something we aspire to do over the coming year.

What career advice would you give to oil & gas professionals (at both junior and senior levels) about navigating the energy transition?

The advice I would give about navigating the energy transition is the same advice I would give about navigating a career in general. At any time in your career, you can really benefit by actively listening to those around you, paying attention to what they mean as well as what they say, and – through respectful questioning – start to enhance your own understanding and knowledge. This might be technical knowledge and understanding, but it could also be social, political or commercial. We need all these skills to move us forward in our careers. By actively listening and paying attention, we can adapt to changing circumstances.

Be flexible! Adapt to change! The oil and gas industry has seen massive changes over my time, and the energy transition is one more change. A flexible approach is needed to avoid being left behind.

In my early days at Phillips, a colleague advised me to always have something interesting printed out so that if the boss walked in you had something to show them. Building on that, I would advise anyone to approach their work as though you might suddenly be asked to explain it to "the boss" or an audience of your peers. I have found that this gives me the internal dialogue "what might they ask?", which provides the framework to dig a little deeper into whatever I am working on.

My final advice is to try and have fun with whatever you do – I know I have.

In these challenging times it is more important than ever that SPE members continue to inspire and support each other locally, regionally, and globally.

SPE has evolved to provide unparalleled insights, shared expertise, life-long learning and community strength to fuel the success of our members and the future of the industry. As a member, you are part of that!

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Energy transition, digitilisation and networking

The SPE Imperial College Student Chapter is dedicated to bringing the latest technology advancements, academic research and insights to students, helping them stay informed and engaged with the latest developments in the industry.

The Chapter has organised various events in 2022 and 2023 to engage members and boost networking, some of which are shared below.

SPE ICL organised several events that focused on the role of petroleum engineers in the energy transition, AI applications for subsurface geoscience and nontechnical events related to interview preparation and CV writing.

In addition, SPE ICL visited bp's International Centre for Business & Technology (ICBT), in Sunbury, London, where students had the opportunity to network with experts within bp.

Energy Transition technical events

- **Fluid flow through porous media: Perspectives for the energy transition presented by our distinguished speaker Professor Martin Blunt, Imperial College London**

- **An overview of underground hydrogen storage presented by Dr Shadi Salahshoor, senior technical leader at GTI Energy Hydrogen Technology Center (HTC)**

- **Experimental characterisation of hydrogen transport in porous reservoirs across scales, presented by Dr Maartje Boon from TU Delft**

  The first hydrogen talk focused on the advantages of subsurface storage over above-ground storage and the challenges of implementing it due to key differences between hydrogen and natural gas storage.

  The second talk presented experimental techniques and theoretical analysis used to characterize hydrogen transport properties in geological porous reservoirs, including wettability, relative permeability, capillary pressure, and hydrogen transport in sandstone rock at the core scale. These talks provided a better understanding of the concepts, technical challenges, and ongoing research and development activities in the field of underground hydrogen storage.

Energy transition, digitilisation and networking... continued

AI and digitalisation technical events

- **Applying AI for reservoir simulation presented by Professor Shahab Mohaghegh from West Virginia University**

- **Applications of machine learning in subsurface geoscience presented by Dr Anatoly Aseev from Intelligent System Labs, SLB**

These events helped SPE members learn how to apply their acquired data science skills within reservoir engineering, which can help in improving the accuracy and reliability of reservoir modeling and prediction and in having faster simulation and analysis of complex reservoir systems.

Moreover, students were introduced to several machine-learning applications in subsurface geoscience including seismic interpretation, prediction of reservoir properties, and subsurface modeling.

Finally, the webinar highlighted the potential of machine learning in improving the accuracy and efficiency of subsurface geoscience operations and enhancing our understanding of subsurface reservoirs.

Non-technical events

Imperial College London

- **SPE industry talk with Mehdi El Faidouzi (senior reservoir engineer) from Genel Energy and Alison Isherwood (technical leader and senior reservoir engineer) from CausewayGT**
- **'How to ace a data science interview' presented by Takunda Jora from Reddit**

Our guest speakers shared their experiences in the energy industry and gave advice to young professionals and students who are interested in joining the industry. The SPE ICL industry talk helped students gain perspective on effective CV writing to land their first job in the industry, skills needed to succeed as a reservoir engineer/data scientist along with an overview of the E&P industry.

SPE ICL is dedicated to helping its members succeed in their career goals and providing opportunities for professional development.

SPE ICL is committed to promoting knowledge sharing, networking, and technical skills enhancement. We will also organise social events throughout the spring season for students to get together and enjoy spring in London.

SPE London section sponsorship opportunities

The SPE International London Section (SPE London) is a not-for-profit technical organisation. Its main purpose is the support of SPE International's mission and vision statement. In fulfilling this purpose, SPE London provides a diverse range of technical and non-technical events to its broad membership base and to non-members.
Strong industry support allows SPE London to fulfil its purpose.

SPE is a well-recognised brand within the broader energy industry, and businesses can leverage their support through many communication channels.

- The section's digital platforms, monthly and Special Interest Groups (SIG) events offer visibility to the association's wide audience of members and non-members.
- Supporting business logos are prominently displayed on the SPE London section website, in the bi-monthly e-magazine (*SPE Review London*), and during SIG events and monthly evening meetings.
- By partnering on shared topics of interest, a business can demonstrate its commitment to Social and Corporate Responsibility (CSR).
- The section offers complimentary access to all live monthly evening and continuing education events, with 4 tickets per £1,000 of financial or equivalent support.

Ways in which your business can support SPE London

- **Traditional direct financial contributions**, which start at £1,000 and are generally of 12-months' duration from January to December.
- **Supporting a specific evening lecture program** is £500, and is offered when a business is presenting at the event or wants to be associated with a particular topic or theme.
- **Special Interest Groups (SIG's)** offer an opportunity to partner on specific industry themes. Support can be for venue/ hosting and may also include promotional materials and 3rd party services.

Key contacts – for more information about how your business can support SPE London

Annual Sponsorship and specific evening lecture support:
Sponsorship Chair, Adrian Southworth, oleumventures@icloud.com

Special Interest Groups

- **Net Zero**: Barny Brennan, *barny.brennan@gmail.com*
- **Diversity and Inclusion**: Isabel Asenjo, *Isabel.Asenjo@eu.sasol.com*
- **Continuing Education**: Adam Borushek, *Adam.Borushek@riscadvisory.com*
- **Young Professionals**: Samad Ali, *sali72@slb.com*
- **Arkwright Engineering Scholarship**: Adrian Southworth, *oleumventures@icloud.com*
- **Digital Transformation**: Ragab Gadrbough, *Raghd.Gadrbouh@cgg.com*

Machine Learning Guide for Petroleum Professionals: Part 1

This is the first part of a four-part series focused on addressing the implementation of AI in the petroleum industry using a real case study.

Written and illustrated by Saif Ur Rehman, this article was first published (February 2023) in *The Way Ahead*, which is written by and for young professionals in oil and gas, covering career development, along with

The research on the application of AI in the petroleum sector has yielded promising results. *PhonlamaiPhoto/Getty Images/iStockphoto*

Artificial intelligence (AI) is a rapidly growing field that is, like electricity, impacting all areas of life, and the petroleum industry is not exempt. Professor Andrew Ng described it as “AI is the new electricity.”

The research on the application of AI in the petroleum sector has yielded promising results. However, as a petroleum professional, you may be wondering how to implement AI. This four-part series will address that question with a real case study.

This first part will discuss the overview of the basics of machine learning, a subset of AI, and how it can be used to make predictions. By the end of this reading, you will have a clear understanding of how machine learning algorithms predict permeability at a given porosity value or similar parameters.

Before diving into the content, it is recommended to allocate at least one hour for reading, as the article will delve into the mathematics behind machine learning. Additionally, having a pen and paper on hand is suggested for taking notes.

Machine Learning Guide ... continued

Start with a basic example. Consider a scenario where the input variable (*x*) is represented by the values: 2, 3, and 4. The output variable (*y*) is determined by **Eq. 1**:

$y = 3x + 5$ (Eq.1)

By plugging each value of *x* into Eq.1, we can calculate the corresponding *y* values: 11, 14, and 17. The relationship between *x* and *y* is linear, as illustrated in Fig.1.

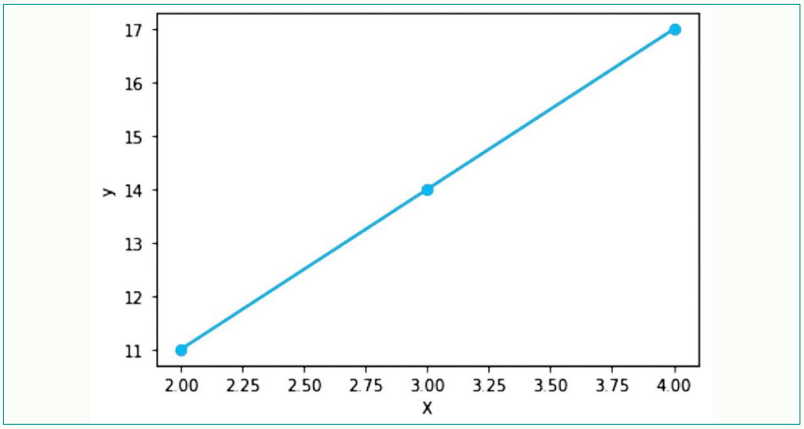


Fig. 1—x vs. y plot. All images created by author.

In this example, we assumed that $y = 3x + 5$. However, in reality, the relationship between the input and output variables is not always known – for example, the correlation between porosity and permeability. All we have is a set of data, as shown in **Table 1.**

x (input)	y (output)
2	11
3	14
4	17

Table 1

So, how do we determine the relationship between input and output (porosity and permeability) so we can then predict the value of *y* for future values of *x*? Machine learning is the answer.

You may recall the equation of a line from high school mathematics: $y = mx + c$, where *m* represents the slope and *c* represents the *y*-intercept. In machine learning, this equation is rewritten as **Eq. 2**, where *w* is the weight, *b* is the bias term, *x* is the input, and $\hat{y}$ is the predicted output, read as y-hat. Remember that *y* is the real value of the output (given in Table 1) and $\hat{y}$ is the value predicted by a machine learning model. Also, note that weight and bias (*w* and *b*) are called parameters.

$\hat{y} = wx + b$ (Eq. 2)

The goal of the machine learning model is to find the best values for the parameters weight (*w*) and bias term (*b*). From Eq. 1 ($y = 3x + 5$), we can see that *w* is 3 and *b* is 5. Therefore, if our machine learning model finds values of *w* and *b* close to 3 and 5, respectively, it will accurately predict the output ($\hat{y}$).

Machine Learning Guide ... continued

First, let's do it manually to understand the background of how machine learning works. Let's choose w and b randomly. Say both are equal to 1 and try to predict the value of $\hat{y}$ for $x = 2$.

$\hat{y} = 1(2) + 1 = 3$

From above, $\hat{y}$ is 3 which is far away from the real value, $y = 11$, (from Table 1, real value of y at $x = 2$ is 11). So, $w = b = 1$ is not a good choice.

Let's change any one of them or both. If I make both w and b equal to 2. The value of $\hat{y}$ at $x = 2$ will be:

$\hat{y} = 2(2) + 2 = 6$

Again, not an excellent fit as real value of y is 11.

Similarly, we can try $w = b = 2$ for other values of x (3 and 4) and you will get a poor match between $\hat{y}$ (predicted value) and y (real value).

You can come up with as many values as you can for parameters (w and b), both positive and negative, until you get a perfect fit. But this tedious task will take a lot of time and effort to find the best values. However, machine learning can do this for us within a few seconds.

At this point, you understand the job of machine learning (finding the best values of parameters). Let's dive deep to know how machine learning models find the parameters.

The first step is to select random values for w and b (weight and bias).

Step 1
Let's initialize the parameters. Say $w = b = 0$.

Use Eq. 2 ($\hat{y} = wx + b$) to find $\hat{y}$ at given x and $w = b = 0$.

At $x = 2$,
$\hat{y} = 0(2) + 0 = 0$

At $x = 3$,
$\hat{y} = 0(3) + 0 = 0$

Similarly, at any other value of x, $\hat{y}$ will be 0, given that $w = b = 0$.

Step 2
I break down Step 2 into three parts. The first part is to find the difference between the $\hat{y}$ (predicted values) and y (real values).

At $x = 2$, $\hat{y}$ is 0 and y is 11, so the difference ($\hat{y} - y$) is -11.
At $x = 3$, $\hat{y}$ is 0 but y is 14, the difference ($\hat{y} - y$) is -14.
At $x = 4$, $\hat{y}$ is 0 while y is 17, the difference ($\hat{y} - y$) is -17.

Machine Learning Guide ... continued

The second part is to square the differences. -11 square is 121, -14 square is 196, and -17 square is 289. These two steps (finding the difference between *y* and $\hat{y}$; then squaring it) is called square error (SE). Mathematically, it is:

SE = ($\hat{y}$-*y*)

Table 2 shows the summary.

x	y	$\hat{y}$	Difference $(\hat{y} - y)$	Square Error (SE) $(\hat{y} - y)^2$
2	11	0	-11	121
3	14	0	-14	196
4	17	0	-17	289

Table 2

The third part is to find the average of all square errors (SE), add all the values of individual SE, and then divide it by the number of inputs. This is called mean square error (MSE). Here, the number of inputs is three (2, 3, and 4). Remember that number of inputs, number of *x*, number of examples, all are the same thing and denoted by *m*. So, MSE is:

$$J = \frac{1}{2m}\sum_{i=1}^{m}(\hat{y} - y)^2 \quad \text{Eq. 3}$$

∑ indicates the sum of all values of SE. To make later calculations faster and neater, we divide the above equation by 2. This division by 2 reduces the amount of time needed to calculate large values of MSE. In regression problems (discussed later), MSE is denoted by *J*. So, the final equation, is shown below.

$$MSE = \frac{1}{m}\sum_{i=1}^{m}(\hat{y} - y)^2$$

This *J* is called the cost function. SE is the square error at one value of *x* while the cost function is the average of all SE.

Let's find the cost function. In Table 2, I summarized all the values of SE. Sum all of them, which is 606, and ultimately, the cost function (*J*) is:

$$J = \frac{121+196+289}{2*m} = \frac{606}{2*3} = 101$$

Now, think about it. If our predicted value ($\hat{y}$) is close to the real value (*y*), the cost function will be small. For example, if *y* is 11 and $\hat{y}$ is 10.80 (pretty close), then SE will be 0.04. The smaller the SE, the smaller the cost function will be.

Therefore, the goal is to make the cost function (*J*) small. The smaller the *J*, the more accurate the model is. And that can only be possible if we find the best parameters (*w* and *b*). How to achieve it? Here comes Step 3.

Machine Learning Guide ... continued

Step 3

The third step is to minimize the cost function by finding the best values for the parameters. Let's draw a curve between *w* and *J* (**Fig. 2**). We can draw a curve through *w*, *b*, and *J,* but it will be 3-D. For simplicity, I just draw for *w* and *J*. In Fig. 2, you can see the value of *J* = 101 (red dot) at *w* = 0.

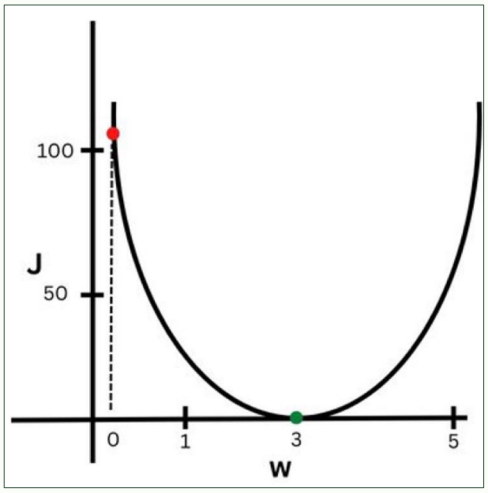


Fig. 2—J vs. W

Now we need to move the red dot closer to the green dot where *J* is near to zero. How do we do that? By taking small steps or jumps (**Fig. 3**).

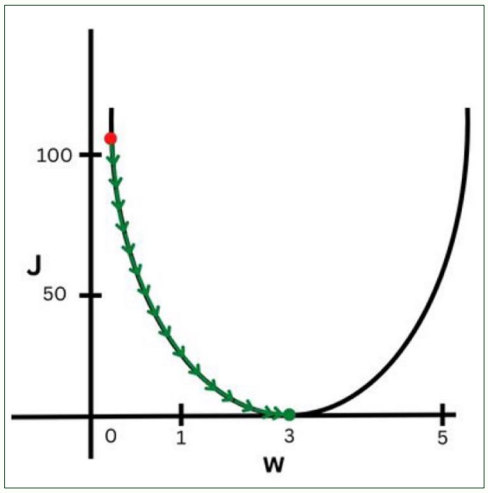


Fig. 3

In Fig. 3, green arrows show the small jumps we need to take to reach from the red dot to the green dot. The step sizes of these small jumps are proportional to the learning rate, denoted by α (alpha). The smaller the alpha is, the smaller the jumps.

However, if the learning rate is very large, then the cost function (*J*) will never converge (reach the minimum or zero). It will move back and forth as in Fig. 4. Therefore, the learning rate value is very important.

As previously mentioned, we need to take small jumps (green arrows in Fig. 3) to converge our cost function *J*. So, how do we do that?

Machine Learning Guide ... continued

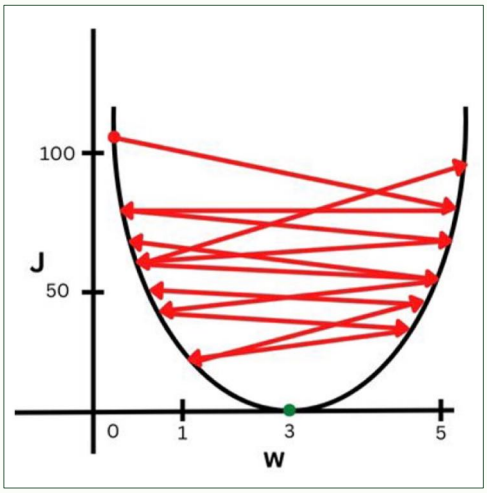


Fig. 4

Answer: Find the slope of the current point (red dot) and then adjust it slowly (small jumps). If you are familiar with calculus, you know that finding the slope means finding the derivative. If you didn't study calculus, don't worry, just remember that derivative and slope are the same thing. So, to find the slope of a line where the red dot is, we need to find the derivative of *J* with respect to *w*. We know from the above-mentioned Eq. 3 that *J* is:

$$J = \frac{1}{2m}\sum_{i=1}^{m}(\hat{y} - y)^2 \quad \text{Eq. 3}$$

From Eq. 2, put $\hat{y} = wx + b$ in the above equation. So,

$$J = \frac{1}{2m}\sum_{i=1}^{m}(wx + b - y)^2$$

If you are familiar with calculus, you know derivative (technically, partial derivative) of the above equation with respect to *w* is:

$$\frac{\partial \bar{J}}{\partial w} = \frac{1}{m}\sum_{i=1}^{m}(wx + b - y)*x \quad \text{Eq. 4}$$

And with respect to *b* is:

$$\frac{\partial \bar{J}}{\partial b} = \frac{1}{m}\sum_{i=1}^{m}(wx + b - y) \quad \text{Eq. 5}$$

Note the difference. Derivative with respect to *b* doesn't have the *x* term in the last part.
So far, so good.

Let's review some basic concepts from high school mathematics. A horizontal line has a slope of zero, a line at 90° has an undefined slope, and lines between 0° to 89° or -91° to -180° have positive or negative values of slope. This is illustrated in **Fig. 5**.

Machine Learning Guide ... continued

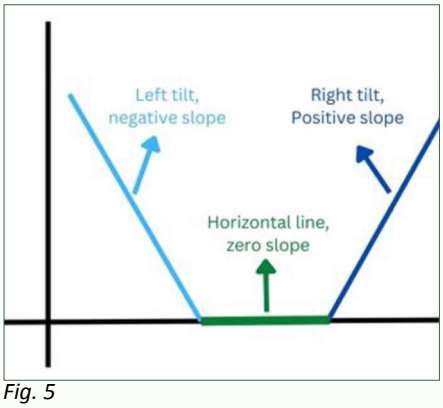


Fig. 5

As shown in Fig. 5, I have drawn three lines. The green line is a horizontal line with a slope of zero. The blue line, which is tilted to the left, has a negative slope value. The cobalt blue line, which is tilted to the right, has a positive slope value. It's important to note that a straight line has the same slope at all points, while a curve has different slopes at different points.

In Fig. 3, the red dot represents a curve that is tilted to the left (negative slope) and the green dot represents a horizontal line (zero slope). To move from the red dot to the green dot, we need to increase the slope (from a negative value to zero). If the red dot were on a curve that was tilted to the right (positive slope), we would need to decrease the slope (from a positive value to zero). The procedure is the same in both cases.

Let's find out the value of slope with respect to *w* and *b* using Eq. 4 and Eq. 5.

$$\frac{\partial \bar{J}}{\partial w} = \frac{1}{m}\sum_{i=1}^{m}(wx + b - y)*x \quad \text{Eq. 4}$$

$$\frac{\partial \bar{J}}{\partial b} = \frac{1}{m}\sum_{i=1}^{m}(wx + b - y) \quad \text{Eq. 5}$$

I compiled all the values with respect to *w* and *b* in **Tables 3 and 4**, respectively. Remember that *m* is 3.

x	y	w	b	$(wx + b - y) * x$	$\frac{\partial \bar{J}}{\partial w} = \frac{1}{m}\sum_{i=1}^{m}(wx + b - y)*x$
2	11	0	0	-22	$\frac{\partial \bar{J}}{\partial w} = \frac{-22-42-68}{3} = -44$
3	14	0	0	-42	
4	17	0	0	-68	

So, from above Table 3, we have a slope with respect to *w* ($\partial j/\partial w$) as -44. Now we have to make it zero or near zero (increasing). To increase the slope, we need to find the new value for *w*. Remember, we will achieve this by taking small jumps. Let's set the small jump (α) value equal to 0.01. The formula for the new *w* (or updated *w*) after a small jump is:

$$w_{(updated)} = w_{(current)} - \alpha * \frac{\partial \bar{J}}{\partial w} \quad \text{Eq. 6}$$

Machine Learning Guide ... continued

Put all the values, $w_{(current)} = 0$, $\alpha = 0.01$, and $(\partial j/\partial w) = -44$

$w_{(updated)} = 0 - 0.01*(-44) = 0+0.44$

$w_{(updated)} = 0.44$

We successfully determined the new value for *w* after one small jump. Let's do the same process for *b*.

x	y	w	b	$(wx + b - y)$	$\frac{\partial \bar{j}}{\partial b} = \frac{1}{m}\sum_{i=1}^{m}(wx + b - y)$
2	11	0	0	-11	$\frac{\partial \bar{j}}{\partial b} = \frac{-11-14-17}{3} = -14$
3	14	0	0	-14	
4	17	0	0	-17	

The slope with respect to *b* ($\partial j/\partial w$) from above Table 4 is -14. Like *w*, we have to make it zero or near zero by taking small jumps. Put all the values, $b_{(current)} = 0$, $\alpha = 0.01$, and = -14 in **Eq. 7**.

$$b_{(updated)} = b_{(current)} - \alpha * \frac{\partial \bar{j}}{\partial b} \rightarrow \text{Eq. 7}$$

$b_{(updated)} = 0 - 0.01*(-14) = 0+0.14$

$b_{(updated)} = 0.14$

Hence, we completed our first iteration (one small jump) and determined the new (updated) values for w and b. This third step is called **gradient descent** (finding the derivatives) and then updating the gradient descent (determining the new values for parameters). Let's revise what we have done so far.

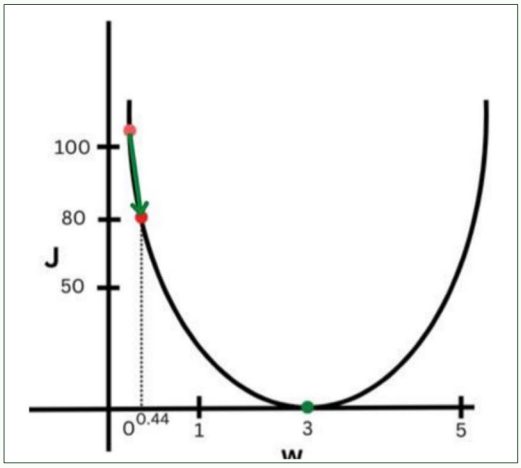
- Initialise parameters: by setting $w = b = 0$.
- Find the cost function: first, find the square error, then sum all the SE and finally determine the *J*.
- Find and update the gradient descent: derivative of cost function and then update the values of *w* and *b*.

Now we have new values for *w* and *b*, 0.44 and 0.14 respectively, after one small jump. So, repeat steps 2 and 3 to get new values for *w* and *b* (updated one more time), after one more small jump (second jump). Remember that *m* is 3. I summarised the step 2 calculation in **Table 5**.

x	y	$\hat{y} = wx + b$	Square Error (SE) $(\hat{y} - y)^2$	Cost Function $J = \frac{1}{2m}\sum_{i=1}^{m}(\hat{y} - y)^2$
2	11	0.44*2+0.14 = 1.02	99.60	$\frac{99.60+157.25+228.01}{2*3} = 80.81$
3	14	0.44*3+0.14 = 1.46	157.25	
4	17	0.44*4+0.14 = 1.9	228.01	

Here, after the first jump, cost function is 80.81 which is less than the previous cost function (101). **See Fig. 6**.

Machine Learning Guide ... continued



Now, repeat Step 3 (finding and updating gradient descent).
First, find out the slope value with respect to *w* and *b* using Eq. 4 and Eq. 5.

$$\frac{\partial \bar{J}}{\partial w} = \frac{1}{m}\sum_{i=1}^{m}(wx + b - y)*x \quad \text{Eq. 4}$$

$$\frac{\partial \bar{J}}{\partial b} = \frac{1}{m}\sum_{i=1}^{m}(wx + b - y) \quad \text{Eq. 5}$$

We compile all the values with respect to *w* and *b* in Table 6 and Table 7.

x	y	w	b	$(wx + b - y) * x$	$\frac{\partial \bar{J}}{\partial w} = \frac{1}{m}\sum_{i=1}^{m}(wx + b - y)*x$
2	11	0.44	0.14	-20.24	$\frac{\partial \bar{J}}{\partial w} = \frac{-20.24-37.62-60.40}{3}$ = -39.42
3	14	0.44	0.14	-37.62	
4	17	0.44	0.14	-60.40	

Now it is time to jump, one more time. The formula for updated *w* after one more small jump is the same as the previous one:

$$w_{(updated)} = w_{(current)} - \alpha * \frac{\partial \bar{J}}{\partial w} \quad \text{Eq. 6}$$

But this time $w_{(current)}$ = 0.44, $(\partial j/\partial w)$ = -39.42 and α is same as previous one, 0.01.

$w_{(updated)}$ = 0.44 – 0.01*(-39.42) = 0.44+0.3942
$w_{(updated)}$ = 0.83

Machine Learning Guide ... continued

x	y	w	b	$(wx + b - y)$	$\frac{\partial \bar{J}}{\partial b} = \frac{1}{m}\sum_{i=1}^{m}(wx + b - y)$
2	11	0.44	0.14	-9.98	$\frac{\partial \bar{J}}{\partial b} = \frac{-9.98-12.54-15.10}{3}$ = -12.54
3	14	0.44	0.14	-12.54	
4	17	0.44	0.14	-15.10	

Now it is time to jump, again. Same formula but $b_{(current)}$= 0.14, $(\partial j/\partial b)$ = -12.54, and you know α = 0.01.

$$b_{(updated)} = b_{(current)} - \alpha * \frac{\partial \bar{J}}{\partial b} \rightarrow \text{Eq. 7}$$

$b_{(updated)}$ = 0.14 – 0.01*(-12.54) = 0.14+0.1254

$b_{(updated)}$ = 0.26

Notice that after the completion of the second iteration, the new values of *w* and *b*, 0.83 and 0.26, respectively, have increased compared to the previous *w* and *b*, 0.44 and 0.14. We need to keep taking small jumps until we get *w* and *b* equal to (or near to) 3 and 5, respectively, as we have *y* = 3x + 5 (Eq. 1). I used Python for 1,000 and 5,000 iterations and summarise the values in **Table 8**.

Iteration	w	b	Cost Function
0	0	0	101
1	0.44	0.14	80.81
2	0.83	0.26	64.57
3	1.18	0.40	51.53
.	.	.	.
.	.	.	.
1000	3.61	3.02	0.13
.	.	.	.
.	.	.	.
5000	3.04	4.90	0.0016

Notice that at the 5,000th iteration, the value of *w* is 3.04 which is close to 3, and that of *b* is 4.90 (close to 5). Also, it would be noticed that the cost is decreasing with every iteration.

That is it!

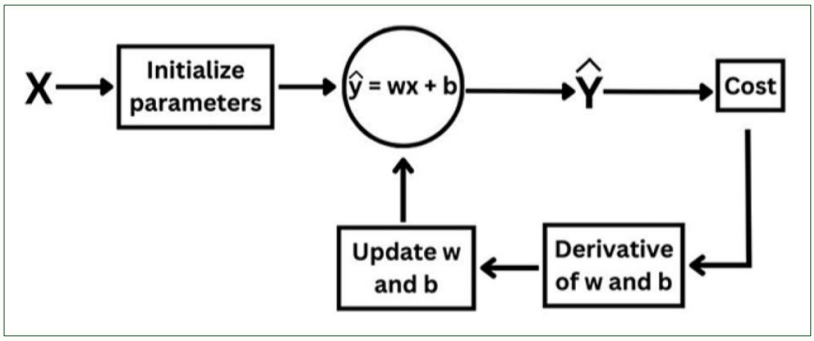
You have successfully trained your first machine learning model (linear regression model). But wait a minute. This is a basic model while real-life problems are complex. So, wait for further parts in this series.

Machine Learning Guide ... continued

Let's add, in passing, some more fun.

We used both input and output to train our model. This type of machine learning (having both input and output) is called supervised learning. On the other hand, in unsupervised learning, we have just input (no output), and the machine learning model's task is to find the patterns within the data. Moreover, in this case, output was a numerical value (from -infinity to +infinity). This type of problem is called a regression problem. While classification problems have a limited set of output options, such as binary outcomes (cat or dog, oil or gas) or multiple categories (cat, dog, or fish; oil, gas, or water).

Up to this point, you know what are cost function and gradient descent. We use $\hat{y} = wx + b$ which is called a linear activation function. In the first step, we initialised parameters (w and b) with zero, in the second step we determined the cost function. This is called feed forward propagation. In the third step (gradient descent), we went back to determine the derivative (slope) and then updated the values of w and b. This is called feed backward propagation. So, machine learning is the combination of both, and named as feed forward back propagation. See **Fig. 7** for a visual representation:



Let's summarise the steps of this basic machine learning model:

- Initialize parameters with zero
- Find the cost function:
    - Square error (SE)
    - Mean square error (MSE)
- Find and update the gradient descent:
    - Derivatives of w and b
    - Update the values of w and b
- Repeat Steps 2 and 3.

For a hands-on experience, **click here** to check the Python code of this basic model. At the end of the code, I have replaced the values of x and y with real-world examples of porosity and permeability.

Feel free to try it with your own data.
If the cost function continues to decrease at each iteration, it indicates that your model implementation is correct.

Congratulations! You are now familiar with:
- Supervised learning

Machine Learning Guide ... continued

- Unsupervised learning
- Regression problem
- Classification problem
- Feed forward propagation
- Feed backward propagation
- Feed forward back propagation
- Linear activation function
- Cost function
- Gradient descent.

Saif Ur Rehman

Saif Ur Rehman is a deep learning mentor volunteer at DeepLearning.AI. With a background in petroleum engineering, he is passionate about merging machine learning with reservoir simulation to provide AI-driven solutions to petroleum industry challenges. He holds a BS in petroleum engineering from Dawood University of Engineering and Technology (DUET), and has been actively involved with SPE since 2015. He is currently serving as the International PetroBowl Question Writing Volunteer for 2023 and held the same role in 2022. He was also an Ambassador Lecturer for SPE in 2021 and served as president of the SPE DUET Student Chapter in 2017.

Building connections and a sense of community

Established in 2011, the SPE University of Portsmouth Student Chapter is dedicated to fostering a sense of community and helping everyone feel more at home.

We believe that building connections is key to success.

The University of Portsmouth Student Chapter hosted many events during 2022 and into 2023. Here are some of the most exciting ones.

Online talk by Julio Hebras, CEO and Founder of MineaOil

The chapter members, being previously from different backgrounds and not necessarily oil & gas or other energy sectors, had the pleasure to meet Julio Herbas, CEO and Founder of MineaOil.

The first half of the talk focused on the future of the energy sector and the oil & gas industry. The second half was dedicated to Exothermic Chemical Treatment, a zero-emissions EOR thermal method for heavy oil recovery. Members described the talk as fascinating and eye-opening.

Online talk by Brian Moffat, founder of Petrophase

Brian Moffatt from Petrophase gave us a talk on reservoir fluid PVT. Brian is a PVT specialist who has consulted on PVT projects for many years.
He founded Petrophase in 2004, which is an award-winning petroleum fluids technical consultancy in PVT, fluid properties and characterisation to the oil, gas and carbon sequestration industries.

The provisional title of the talk was '40 years of PVT condensed to 40 minutes'.

Wytch Farm Trip in June 2022

In June 2022, to gain some insight and first-hand experience in the oil and gas industry, we organised a field trip to the Wytch Farm field.
It is a producing conventional oil field onshore, operated by Perenco UK.

Chapter members had a unique opportunity to meet the professionals and the alumni student working at Perenco, who introduced us to the field, explained how it operates and answered all our questions.

SPE Social Events: BBQ and Bowling

We have organised several social events so our newest chapter members can get to know each other, including our BBQ and bowling events.

With many international members, these events have been particularly valuable in fostering a sense of community and helping everyone feel more at home. We believe that building connections is key to success, and we're thrilled to see our members coming together.

Building connections and a sense of community... continued

SPE University of Portsmouth Student Chapter committee

Student members elect officers annually. Here is a brief introduction to the SPE University of Portsmouth Student Chapter committee members for 2022/23.

President:
Jakub Cebula

Jakub holds a Bachelor of Engineering in Petroleum Engineering from the University of Portsmouth. He is currently pursuing a Master's degree in Petroleum and Gas Engineering. He is primarily focused on the application of Data Science, Artificial Intelligence (AI), and Machine Learning in the oil, gas and energy sectors. Additionally, he has conducted research on numerical simulation and modelling of CO_2, academic research on CCUS numerical simulations and modelling.
His aim is to increase the Chapter's engagement and community aspects, enabling its members to further develop their technical skills in the dynamically evolving energy industry.

Vice-President:
Mohamed Hassan Idris

Mohamed Hassan Idris is a reservoir modelling and field development expert, experienced in leading multidisciplinary teams for exploration, development, and production projects.
He has worked across various sectors in his career, including service companies and operators.
His main interests lie in machine learning and data science applications for oil and gas, especially time-series analysis and forecasting for the Sudan National Petroleum Corporation, Sudapet.

Secretary:
Newton Okwuoha

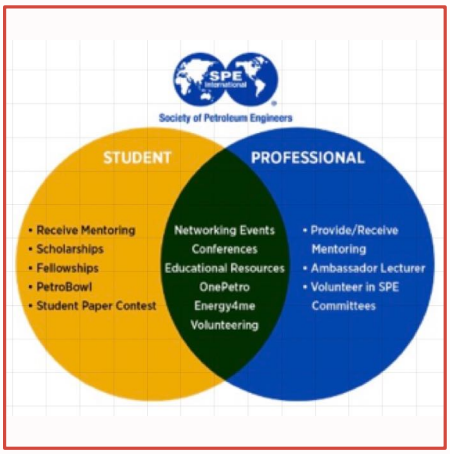
Newton completed his undergraduate degree in Chemical Engineering and is currently pursuing a Master's degree in Petroleum and Gas Engineering. He previously worked on a project titled 'Techno-economic Analysis of Methanol Production from Natural Gas', where he gained core experience in Aspen Hysys software. He also completed internships in the mining, consumer goods, and other industries. His main interest lies in implementing data science and artificial intelligence into the oil & gas industry, and his thesis will be related to exploring unconventional reservoirs using machine learning.
Outside academia, he also serves as a student ambassador and a graduate outcomes advisor for the graduate calling program at the university.

Treasurer:
Hichem Benarouche

Hichem's educational background includes a Bachelor's degree in Geology (Honors) from the University of Pretoria, South Africa. He also holds a post-graduate degree in Chemical Engineering with a specialisation in Oil and Gas Engineering from the University of the Witwatersrand in Johannesburg. Currently, Hichem is pursuing an MSc in Petroleum and Gas Engineering at the University of Portsmouth.
He is dedicated to enhancing the experience of SPE Portsmouth chapter members, focusing on creating opportunities for colleagues to develop and grow their skills, with the goal of helping them succeed within the oil and gas industry.

Free Year of Membership for Graduating SPE Student members

You did it! You made it to graduation and are ready to begin an exciting career in the oil and gas industry. Because SPE is committed to your success, your first year of SPE Professional membership is free.



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SPE events calendar – local and international

LOCAL – in the UK

May 22 (in person/online)
SPE Virtual Career Pathways Fair 2023
This evening meeting is hosted by the SPE London Section at Imperial College, Royal School of Mines, and also broadcasted by live streaming.
Marise Mikulis, SPE Distinguished Lecturer will discuss, in person, how to accelerate disruptive change, and George Bridle, SPE Distinguished Lecturer will present, online with livestream only, a case study on a low-temperature geothermal project.
Register and book in advance.
More information: **SPE London dinner event**

September 5-8 (Aberdeen, Scotland)
SPE Offshore Europe Conference and Exhibition
Theme: *Accelerating the transition to a better energy future – securing sustainable and equitable energy for the next 50 years and beyond*
Celebration of 50 years of innovation within the energy industry. This event will bring together the energy sector's value chain to drive forward the oil & gas sector, with an exhibition that showcases the industry's innovative solutions. The theme ties in four key themes: energy security, energy transition, innovative technology, and future talent.
More information: **offshore-europe.co.uk/en-gb.html**

INTERNATIONAL

May 16-17 (Baku, Azerbaijan)
SPE Workshop: Sand Management from Pore to Process
This workshop will take a deep look at the challenges related to sand from several different perspectives including the reservoir, wellbore and the surface facilities.
The goal of the workshop is to bring together professionals from industry, academia and research to share experience and to brainstorm to develop new ideas to solve the diverse challenges faced in all sand producing plays.
More information: **SPE Workshop**

June 5-8 (Vienna, Austria)
SPE EuropeEC – Europe Energy Conference featured at the 84th EAGE Annual Conference & Exhibition
The conference brings together key leaders and professionals from the energy, oil and gas, mining and other subsurface industries providing a unique opportunity for collaboration, research and innovation with the aim to advance decarbonisation. More than 1,300 technical oral and e-Poster presentations provide insights covering every aspect of geoscience and related engineering topics.
More information: **SPE EuropEC conference**

June 13-15 (Denver, Colorado, USA)
The Unconventional Resources Technology Conference
URTeC focuses on the latest science and technology applied to exploration and development of unconventional resources, with special emphasis on integration of the technical/professional disciplines. Exchange information, formulate strategic ideas, and solve problems to manage and optimise your unconventional resource plays. The innovative virtual event features technical talks, panel discussions, and team presentations.
More information: **URTeC conference**

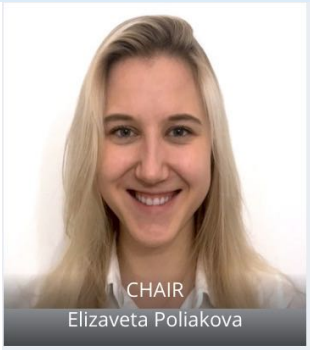
August 15-16 (Galveston, Texas, USA)
Gas & Oil Technology Showcase and Conference
This is a great opportunity to connect the global oil & gas industry to discuss challenges and best practices across the oil & gas industry. Focus will be on the use of technologies and innovative solutions to address key technical topics such as well designs & completion, R&D in EOR, role of analytics and AI solutions for field development, production enhancement, new concepts in geoscience & reservoir characterisation, and polymer flooding and low salinity technologies.
More information: **Workshop**

For a complete listing of all events on the SPE Global Events Calendar: spe.org/en/events/calendar/
And, for more information about SPE training courses, calls for papers, and opportunities for sponsorship: sponsorship.spe.org/en/events/about-events/

Meet the SPE London Board

SPE is a non-profit professional society with more than 156,000 members in 154 countries, who participate in 203 sections and 383 student chapters. SPE's membership includes 72,000 student members. The SPE London Section, with an average 2,000 members and seven associated student chapters, is an active section with an aim to connect, engage and promote the exchange of knowledge within the London energy community of technical and commercial professionals. The SPE London board is the governing body for the SPE London section. The different committees oversee the chapters various activities including the evening programme, various SPE events, Young Professionals, Women in Energy and associated student chapters.

SPE SECTION EXCELLENCE *** AWARD *** 2020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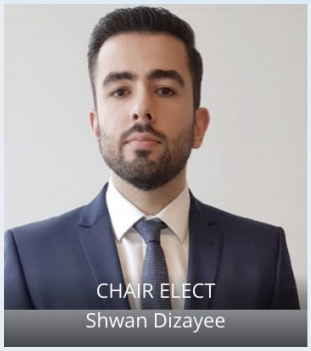
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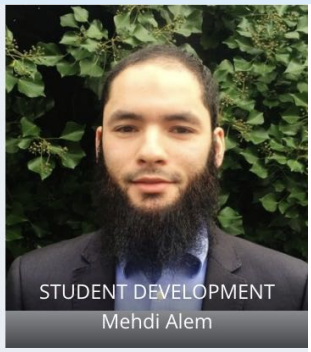
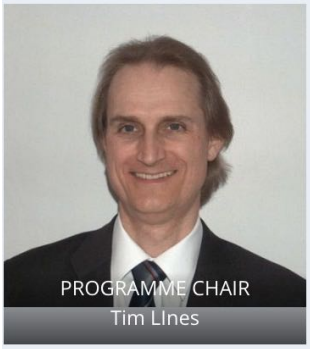
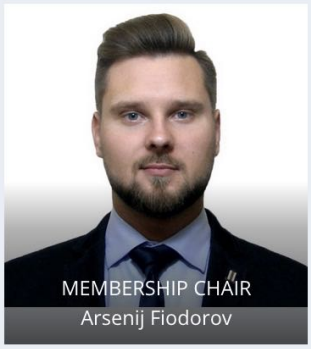
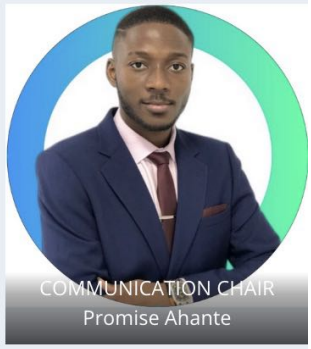

STUDENT DEVELOPMENT
Mehdi Alem

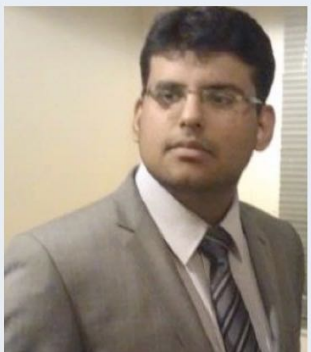

PROGRAMME CHAIR
Tim Llnes


SPONSORSHIP CHAIR
Adrian Southworth


MEMBERSHIP CHAIR
Arsenij Fiodorov


COMMUNICATION CHAIR
Promise Ahante


CONTINUING EDUCATION CHAIR
Adam Borushek

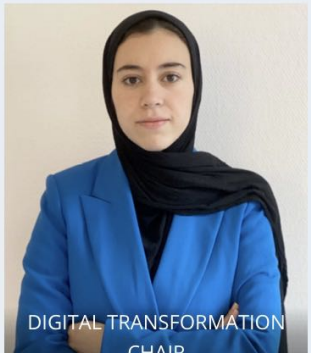

YP CHAIR
Samad Ali


SOCIAL CHAIR
Percy Obeahon


INTER SOCIETY / INDUSTRY
Carolina Coll


NET ZERO CHAIR
Barny Brennan


WiE CHAIR
Isabel Asenjo


DIGITAL TRANSFORMATION CHAIR
Raghd Gadrbouh


PAST CHAIR
Adam Zalewski