Institute
and Faculty
of Actuaries

Ethical and professional guidance on Data Science:

A Guide for Members

By the Regulation Board

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Contents

1. Introduction

1.1 The term Data Science is generally associated with the collection of large amounts of data that can be analysed using advanced computational methods to gain insight into any trends, patterns and associations. The insights gained from the data can then be used to infer something about the future. Data science brings together several fields including computer science, statistics and mathematics. Members of the Institute and Faculty of Actuaries (IFoA) have always been involved in analysing data and are becoming increasingly involved in data science related work.

1.2 Used responsibly data science has the potential to offer many benefits. However the use of data science techniques can create significant practical and ethical challenges for data science practitioners and IFoA Members involved in data science related work.

1.3 The IFoA believes that the high standards to which IFoA Members are subject to will enhance the value of their contributions in data science related work. In order to maintain the reputation of the actuarial profession it is important that IFoA Members are aware of relevant ethical, professional and technical standards that apply to them with respect to data science related work.

1.4 This guidance follows on from the IFoA's jointly published, high level, Ethical Guide for Data Science with the UK's Royal Statistical Society. The purpose of this IFoA specific Guide is to provide IFoA Members with practical and ethical guidance on how their professional and regulatory obligations relate to work that they undertake in data science. This Guide covers practices that actuaries have followed for years and therefore it applies to a wide variety of Members, including Members who use traditional methods of data analysis.

1.5 The Guide also provides various case-studies and illustrative examples, which we hope will be of practical value to Members when faced with ethical and professional issues or dilemmas when undertaking data science work.

1.6 This Guide does not contain an exhaustive list of the relevant professional and regulatory obligations, and other requirements may be applicable depending on the circumstances of the work being carried out.

2. Professional obligations and data science

2.1 Members of the IFoA might face professional and ethical dilemmas when undertaking data science related work and may find it helpful to consider their professional and regulatory obligations further within this context.

2.2 Member's ethical, professional and regulatory obligations are set out in the IFoA's current standards framework.

2.3 The IFoA's current standards framework is made up of:

i. The Actuaries' Code ('the Code');

ii. Actuarial Profession Standards ('APSs');

iii. Non-mandatory guidance;

iv. The IFoA also requires Members carrying out work that is within UK geographic scope to comply with the Financial Reporting Council's (FRC's) Technical Actuarial Standards (TASs).

2.4 This Guide provides non-mandatory guidance for IFoA Members and it is not compulsory for Members to comply with this material. Rather, the IFoA hopes that it will assist Members in complying with their obligations and help to build on the requirements set out in the Actuaries' Code and in the TASs.

2.5 The aspects of the IFoA's current standards framework that are relevant for particular data science related work will depend on the circumstances of the work. The following sections outline how each aspect of the IFoA's current standards framework could be relevant for data science related work.

2.6 Actuaries Code

2.6.1 The Code is the overarching ethical code of the IFoA. It sets out principles that all Members must comply with and aims to build and promote confidence in the work of actuaries and in the actuarial profession. The Code applies at all times to Members' conduct in relation to an actuarial role and also applies to other conduct if that conduct could reasonably be considered to reflect upon the actuarial profession.

2.6.2 The Code does not define 'actuarial role'; however this might include circumstances where a Member is performing a role that requires, or benefits from, specific actuarial skills. This can therefore include data science related work, which may benefit from Members' actuarial skills. Additionally, the work that Members undertake in data science could potentially reflect upon the profession as a whole.

2.6.3 Some areas of consideration for Members with regards to data science related work are outlined below. This is not intended to be a comprehensive look at the Code's requirements, but rather an outline of how some of the Principles can relate to data science.

Principle 1 Integrity

2.6.4 A key aspect of data ethics is to seek to enhance the value of data science for society, and under the first Principle of the Code, Members must act honestly and with integrity. The impact, including the outcomes and consequences that data science can have on society could be significant, and if IFoA Members are involved in this work they will be expected to act in an ethical and professional manner, and to be honest and fair. If data is used improperly and practitioners do not speak up about this, it could have detrimental consequences for society as a whole.

2.6.5 Data science also has the potential to cause harm to individuals, and the general public are entitled to expect that sensitive information will not be misused, treated carelessly or be shared without their permission. Under this Principle, Members should respect confidentiality and consider this when they have access to potentially sensitive information.

2.6.6 Possible relevant examples of integrity in data science related work could include ensuring that:

- Appropriate consent is obtained for the purpose that data is to be used
- There are safeguards to prevent data being used in a manner which results in unfair or discriminatory outcomes for users; and
- Data is not used for a purpose for which the appropriate consent has not been obtained.

(relevant to the legal requirements on data protection and privacy under the EU's General Data Protection Regulation (GDPR))

Principle 2 Competence and care

2.6.7 Members are encouraged to develop their experience in new fields and pursue new areas of work. They may become increasingly involved in data science projects that they have not had previous exposure to. Under the Code, Members are expected to ensure that they have the right level of knowledge and skill for the piece of work that they are undertaking. This ensures that users and the public can continue to trust Members to be competent to perform the services that they are engaged in.

2.6.8 It is becoming increasingly common in data science related work for actuaries to work in multidisciplinary teams with a range of non-actuarial professionals such as data scientists, computer analysts and statisticians. Actuaries can fulfil different roles within these teams. If a Member feels that they do not have the right level of knowledge to perform the requested task in the project, they can resolve this by working with more experienced team Members, or by obtaining training, for example.

2.6.9 As detailed in the Guide for Ethical Data Science, detailed below, possible examples of professional competence within data ethics could involve:

- Ensuring that there is a full understanding within the project team of the sources of error and bias in data and keeping models under regular review
- Obtaining input from other suitably knowledgeable professionals. This is particularly relevant where given the complexity of many data science related projects, it is unlikely that an actuary will be an expert in all aspects, nor may the actuary have responsibility for all aspects of the project.

Principle 3 Impartiality

2.6.10 Members are expected to present information in a way that is accurate and impartial, and to ensure that their professional judgement is not compromised, and cannot reasonably be seen to be compromised, by bias, conflict of interest, or the undue influence of others.

2.6.11 Possible examples of impartiality in data science related work could include:

- Members ensuring that they identify and understand all of the potential biases in the data they are analysing
- Ensuring any potential biases are communicated transparently to the users and stakeholders
- Where Members are working within a multidisciplinary team, with data scientists for example, ensure that they consider the risks of conflicts of interest and bias and communicate this to the wider team so that appropriate action is taken. It will be helpful for Members to explain to other team members their professional responsibilities in this area.

Principle 4 Compliance

2.6.12 Under this Principle, Members must comply with all relevant legal, regulatory and professional requirements. This includes any rules governing matters in the area in which a Member is practising. All practitioners working in the emerging field of data science will be required to

comply with any relevant laws, regulations and professional requirements. These will not necessarily always be those that apply in the geographic location where the Member carries out their work, for example, where a Member works remotely but carries out work for an entity in another country.

2.6.13 Members may work in industries that are subject to high levels of regulation, such as financial services, with a wide range of legal, regulatory and professional requirements to consider. Additionally, there may also be specific issues for consideration with respect to data science.

2.6.14 Possible relevant examples of compliance in data science related work could include:

- Transparency for consumers with regards to the information that is collected and how this data is being used
- Compliance with local regulations could mean that certain types of data cannot be used for particular purposes
- Compliance with consumer data protection regulations
- Compliance with cyber security regulations.

2.6.15 The value of Members' work in data science for key stakeholders will be enhanced if those stakeholders are confident that relevant legal and regulatory requirements have been fully considered and complied with. This will also help to increase the public's trust and confidence in the work of data science practitioners.

Principle 5 Speaking up

2.6.16 Members have a responsibility to speak up in certain situations and under Principle 5, they should speak up if they believe that a course of action is unethical or unlawful. It is an essential part of being a professional actuary to raise or identify issues in the work they are involved in (data science related work or otherwise) before harm is caused or to prevent any further damage being caused.

2.6.17 Members may have concerns with the behaviour of other actuaries, or non-actuaries in multidisciplinary teams and could come across activity that they believe to be unethical or unlawful, which they should speak up about. Additionally, if Members have had significant involvement in a data science project, they must take reasonable steps to make users aware of any substantial issues, if it might reasonably influence the judgement of the users. It can help, when working in a multidisciplinary team, to establish the lines of responsibility from the outset.

2.6.18 Possible examples of speaking up in a data science related project could include the Member highlighting any concerns to users with respect to:

- The quality of the data (which is a requirement under TAS 100, discussed further in paragraph 2.8 below)
- How the data was collected and the use to which that data was put;
- Who was responsible for collecting the data – particularly if this was a third party; and/or the accuracy of the results.

Principle 6 Communication

2.6.19 Given the complexity of some of the techniques involved in data science, particular care is required to ensure that communications are not misunderstood or misinterpreted.

2.6.20 Principle 6 of the Code states that Members must communicate appropriately and take reasonable steps to ensure that any communication for which they are responsible, or had significant involvement in, is accurate, not misleading and contains an appropriate level of information. It could potentially be very challenging for Members to explain the results and techniques used in data science related work and therefore care is needed to ensure that the communication is in a form that the user will understand.

2.6.21 Particular care is also required where communications are aimed at a non-technical audience to explain actions as far as possible. There may be a wide range of stakeholders with different requirements. This could include regulators, policyholders and management. A considerable challenge for certain data science techniques is the ability to explain the results in a way that key stakeholders (e.g. senior management or the regulator) can understand.

2.6.22 As mentioned above, if Members are working in a multidisciplinary team, it may be helpful to establish the lines of responsibility to help make clear accountability for any work carried out by them.

2.6.23 Below is an illustration designed to look specifically at the communication principle and the challenges that a Member may face when working with a complex data science model:

Communication – Illustration

- Alan is an actuary who has been asked to develop a predictive model for pricing a brand new health insurance product.

- Alan has considered a number of models and determined that using an artificial neural network approach for the model will provide the best predictive power, compared to the more traditional models the company has used for other products in the past.

- Alan knows that all models have to be presented to his company's Strategy Committee for approval before they can be used. The committee includes technical and non-technical professionals. His presentation of the model therefore needs to be at a level that is simple enough for all members of the committee to clearly understand how the model works and the key assumptions and judgements underlying it, but without being overly simplistic.

- Alan can see that if he chooses the neural network model, it may be difficult for him to explain how it works at the committee due to its complexity, whereas the Committee are already familiar with the traditional pricing models. However, Alan expects the neural network approach will be better able to model the future experience of the new product, so he would prefer to use that.

- **Discussion points:** What issues does Alan need to consider when thinking about how to communicate the new model? What steps can Alan take to overcome the complexity?

2.7 Actuarial Profession Standards

2.7.1 All Members who are undertaking data science work are required to comply with all applicable provisions of the relevant mandatory Actuarial Profession Standards (APSs). The list outlined below is not intended to be exhaustive, and other APSs may be applicable depending on the circumstances of the work being carried out.

APS X1: Applying Standards to Actuarial Work

2.7.2 This sets out principles to be applied by Members to determine which standards they must or should be applying to a piece of work. It makes clear that Members must comply with the law that applies to the work they are undertaking.

2.7.3 APS X1 states that Members should ensure that their 'Actuarial Work' is carried out in a way that is substantially consistent with the International Actuarial Association (IAA)'s International Standard of Actuarial Practice (ISAP) 1 and the FRC's Technical Actuarial Standards (TASs) for work within the UK geographic scope. It defines 'actuarial work' as work undertaken by a Member in their capacity as a person with actuarial skills on which the intended recipient of that work is entitled to rely. This may therefore include work that Members undertake related to data science, as it could involve Members carrying out calculations, modelling or giving advice or recommendations in their capacity as an actuary. It is therefore important to consider whether there is an obligation to apply ISAP 1 to the work in question, which may be more difficult to distinguish in a data science project.

2.7.4 If Members are carrying out data science work outside of the UK geographic scope, APS X1 requires Members to exercise reasonable judgement to consider whether there are other relevant standards that they ought to apply. Members working in data science, and other practitioners, may need to investigate what the relevant requirements are to the work that they are involved in, in the relevant jurisdiction, and ensure their work complies with these.

APS X2: Review of Actuarial Work

2.7.5 APS X2 applies to all Members and relates to the need to consider the extent to which review (including independent peer review) is required for any 'actuarial work' (work undertaken by a Member in their capacity as a person with actuarial skills on which the intended recipient of that work is entitled to rely).

2.7.6 APS X2 is potentially very relevant for data science related work and Members may need to consider the difficulty and complexity of the work in deciding whether a review should occur and the extent of that review. If a review is being carried out, it is important to understand the involvement of various parties, particularly in a multidisciplinary team, and what is expected of them.

2.7.7 Any reviewer will need to understand and be provided with all the information regarding the work and the context in which it is undertaken. If it is another actuary reviewing the work, they may not be familiar with data science aspects of the project. APS X2 does not specify that individuals carrying out the review be qualified actuaries, therefore it may be appropriate for different parties, with suitable skills and experience, to undertake a review.

2.7.8 Similar practitioners working in data science will often consider inviting peer and technical bias review of their work, in order to demonstrate and apply professional competence. Members of the IFoA may be able to share best practice in this area with other professionals.

2.7.9 Below is an illustration designed to look specifically at applying APS X2 in a data science setting:

Peer-review – Illustration

- Jagpal is a newly qualified actuary working in a non-life pricing team and has recently taken a course on machine learning techniques. He is the first member of his team to get to grips with data science and has built a new risk price model using ensemble methods.

- The team has an internal independent peer review process in place which involves the Senior Actuary, Elizabeth, reviewing the work of other team members. But Jagpal knows that Elizabeth has not done any machine learning modelling before.

- Jagpal has spoken to Elizabeth about his concerns but Elizabeth says its fine - she's sure she can manage to do a 'high level' review as she attended a presentation on machine learning last year at an industry seminar, and there's no one else in the team with more experience than her anyway. However Jagpal is still not convinced that Elizabeth has sufficient experience for a thorough review of the new model.

- **Discussion points:** Who is responsible for considering APS X2 – Jagpal or Elizabeth? What actions could Jagpal consider to ensure the obligations under APS X2 are appropriately met?

2.8 Technical Actuarial Standards

2.8.1 The UK Financial Reporting Council (FRC) sets mandatory Technical Actuarial Standards (TASs) within the UK geographic scope and IFoA Members must comply with relevant TASs. These applies to 'technical actuarial work' performed for a user:

- Where the use of principles and/or techniques of actuarial science is central to the work and which involves the exercise of judgement; or
- Which the user may reasonably regard as technical actuarial work by virtue of the manner of its presentation.

2.8.2 Members might use some aspects of actuarial science to complete work related to a data science project, and users or other team members may regard the work completed by Members as 'technical actuarial work' Therefore, TASs can also apply to Members' work in data science.

TAS 100: Principles for Actuarial Work

2.8.3 TAS 100 in particular comprises of six high level outcome-focussed principles which are applicable to all technical actuarial work carried out within the FRC's UK geographic scope and sets out the standard of technical actuarial work that users are entitled to expect.

2.8.4 The six high level principles in TAS 100 are on Judgement, Data, Assumptions, Models, Communications and Documentation. The principles within TAS 100 are highly relevant to data science related work.

2.8.5 If Members are contributing to a piece of work within a multidisciplinary team, discussing compliance with TAS 100 at an early stage is helpful to determine who is responsible for all or part of the work, agree who has responsibility for ensuring compliance and to clarify expectations around documentation and reporting.

<u>Judgement</u>

2.8.6 Members will often be in an important position to add value to data science related work through their domain knowledge. For judgement to be reasoned and justifiable, Members can perform proper analysis and validation of results, in order to avoid results from data science techniques that could be seen as misleading. In applying judgement, Members can consider the context of the data and techniques used, with care to avoid simply accepting the results of any data science related modelling without question

Data

2.8.7 TAS 100 states that 'Data used in technical actuarial work shall be appropriate for the purpose of that work so that users can rely on the resulting actuarial information.' Members checking that the data used in data science related work is appropriate to the purpose of the user must confirm that the results are not misleading. It may be necessary to carry out appropriate checks and adjustments to do this. Members will be aware of the potential for technical bias, which may appear as a result of technical constraints or limitations of the software or algorithms.

2.8.8 If applicable, Members need to ensure that communication about the data is sufficient to give confidence to the users that the results of the work are reliable.

Models

2.8.9 TAS 100 states that 'Models used in technical actuarial work shall be fit for the purpose for which they are used and be subject to sufficient controls and testing so that users can rely on the resulting actuarial information.' This requirement is relevant for data science related modelling and when Members are working in multidisciplinary teams. When working in these settings, Members are expected to consider whether the controls and testing in place are sufficient, if the model is fit for the purpose (as required by the user(s)) and ensure that the results of the model are not misleading for the user(s).

Communications

2.8.10 TAS 100 states that 'Communications shall be clear, comprehensive and comprehensible so that users are able to make informed decisions understanding the matters relevant to the actuarial information.' As discussed above in relation to the Code, particular care is needed when using certain data science techniques and it is crucial to explain the results in a way that key stakeholders can understand.

Documentation

2.8.11 Finally, TAS 100 also states that 'Documentation shall contain enough detail for a technically competent person with no previous knowledge of the technical actuarial work to understand the matters involved and assess the judgements made.' As discussed above, data science techniques can be challenging and complex. Members should take care to ensure that they clearly document their work in a manner that a non-technical competent person would be able to understand.

2.8.12 If Members require further guidance on TAS 100, the IFoA has issued Guidance on the practical application of it.

2.9 IFoA guidance

2.9.1 The IFoA has various non-mandatory guidance that Members may find helpful when undertaking data science related work, including:

A Guide for Ethical Data Science

2.9.2 A useful starting point for Members working in data science is the IFoA's joint guidance with the UK Royal Statistical Society. This considers five recurring ethical themes from a range of existing ethical frameworks and working practices across a wide range of sectors and

industries. Within each of these themes are examples of corresponding working practices which aim to help Members consider data ethics. Including:

- Seek to enhance the value of data science for society
- Avoid harm
- Apply and maintain professional competence
- Seek to preserve or increase trustworthiness
- Maintain human accountability and oversight.

2.9.3 The joint guidance is intended to complement the IFoA's current standards framework, which is discussed above, by addressing some of the ethical and professional challenges of data science related work. The guide is also non-mandatory guidance in the IFoA's current standards framework.

The Actuarial Software and Calculations – Professional Responsibilities (ASCPR)

2.9.4 This provides guidance for Members on the use of third party software to provide actuarial calculations. It explains actuaries' professional responsibilities when they provide advice or actuarial information that relies on data or calculations provided by computer models or software programs.

2.9.5 It states that Members must use their professional judgement when using or relying on third party information, whether from a computer model or another actuary. The amount of checking required is a matter for their judgement exercised in the context of the purpose and scope of their advice. It states that actuaries should agree where professional responsibility lies for the data, assumptions, models and the resulting advice, and the level of reliance that can therefore be placed on the advice.

Climate change risk alert

2.9.6 A recurring theme within data ethics is for practitioners to avoid harm, as detailed in the joint Guide for Ethical Data Science. A part of this ethical theme is to consider the impact of the work on the environment and its resources.

2.9.7 The IFoA has a climate change risk alert that states that actuaries should ensure that they understand, and are clear in communicating, the extent to which they have taken account of climate-related risks in any relevant decisions, calculations or advice. It asks Members to consider the relevance of climate-related issues in relation to:

- Physical risks (arising from potential degradation to physical assets)
- Transition risks (which depend on the nature and speed of mitigation and policies from governments or regulators)
- Liability risks.

Guidance to support the Actuaries' Code

2.9.8 This is a tool for Members to use their own judgement in determining how to comply with the provisions of the Code. It contains information about each of the six principles within the Code.

3 Case studies

3.1 The illustrations within this Guide aim to assist Members in understanding how their professional obligations are put into practice when providing advice or recommendations in

data science. Some possible answers to the discussion points are provided in Appendix A, as well as some further case-studies which we hope will be useful for Members.

The content of this Guide will be kept under review and for that reason we would be pleased to receive any comments on it. These may be directed to dataethics@actuaries.org.uk or via post to:

The Regulation Team
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Level 2 Exchange Crescent
7 Conference Square
Edinburgh EH3 8RA

Appendix A: Illustration discussion points and further case studies

Communication illustration – discussion points

- What issues does Alan need to consider when thinking about how to communicate the new model?

  The UK FRC's TASs (discussed earlier) highlight the importance of communicating the degree of reliance which can be placed on the results of a modelling exercise. Alan can think about what aspects of the modelling are most important to get across to the committee. This is likely to include such as the limitations of the data or modelling and the uncertainty of the results.

  Alan should consider his audience and ensure that the language used in the communication is suitable, taking care to define any technical terms they may be unfamiliar with.

  As discussed in the IFoA's Guide for Ethical Data Science, practitioners could consider minimising unnecessary complexity in methods to improve transparency and communication, if possible.

- What steps can Alan take to overcome the complexity?

  There are a number of tools available to help make the results of complex models more interpretable, such as partial dependence plots and feature importance analysis, as well as visualisation techniques.

  Alan can consider presenting the validation he has done on the model and explaining why this gives him confidence in the outputs to the committee.

Peer review illustration – discussion points

- Who is responsible for considering APS X2 – Jagpal or Elizabeth?

  Jagpal is responsible for considering the obligations under APS X2 for his work and ensuring that any appropriate review has taken place.

- What actions could Jagpal consider to ensure the internal peer review is appropriate?

  Jagpal should consider all of the relevant circumstances listed at paragraph 1.3 of APS X2 when determining if the proposed independent peer review would be appropriate.

  He could remind Elizabeth about the Competence and Care principle of the Actuaries' Code. If Jagpal is concerned that Elizabeth does not have sufficient skill and knowledge to carry out the review, then he could respectfully suggest to her that an external reviewer with data skills could assist/support the review (for example, from another team within the company or an external firm).

  If Elizabeth insists on doing the review alone and Jagpal does not believe this is appropriate, he could speak to a senior actuary or other manager in the firm about the situation to seek their advice and support. Jagpal can also contact the IFoA's free Professional Support Service for advice.

CASE STUDY 1

Insurance companies are increasingly using virtual assistants, often referred to as 'chatbots', to automate the sale of their products.

Potential clients are required to answer a series of pre-determined questions via text or voice. The chatbots use algorithms which filter the client's responses to the questions and based on the responses, recommend an appropriate product for that client.

You are a senior actuary working for a consultancy that designs chatbot algorithms for a number of insurance companies, providing differing products in various territories.

The same core algorithm methodology is used by the consultancy for all insurance companies. However, the consultancy tailors the algorithm for each company to reflect their particular products and customer base. The tailoring works by adjusting the questions that the clients are asked, and also how the client's responses are filtered to determine the product recommendation.

The chatbots are being used directly with consumers via company websites and also via brokers where the insurance broker can use the tool to support their own discussion with the client about their insurance needs and help find suitable products.

You manage a small team of actuaries and non-actuaries responsible for developing the chatbot functionality for each company. The actual work of tailoring the algorithm for an insurance company is carried out by junior non-actuarial members of the team.

One of the brokers who has been using the chatbots for some time has noticed that algorithms often suggest products which they don't consider appropriate for their clients. They have raised their concerns with the company and also talked to the insurance regulator as they expect the issues could be widespread wherever these algorithms are being used.

The regulator has asked the insurance company for the details of their chatbot and explanation of how the algorithm works.

Questions

1. Consider what ethical challenges there are in designing the chatbot algorithm. What are your obligations under the Actuaries' Code?

2. Are there any potential challenges or risks for the insurance company in using chatbots in its sales process?

3. What controls could be put in place by the insurance company to mitigate the risks from 2 above?

4. What concerns might a regulator have with regards to an insurance company selling its product via a chatbot?

Discussion points

1. The actuaries on the team will be required to consider their obligations under the Actuaries' Code as, although they are not necessarily carrying out 'traditional' actuarial roles, it is likely that their work on the algorithm requires or benefits from their actuarial skills. Additionally, the actuaries' work on this project could reasonably be considered to reflect on upon the actuarial profession as a whole.

   Under the Competence and Care principle of the Code, the actuaries need to ensure that they had the right level of knowledge and skill, when designing the chatbot algorithms. Among the

issues they should have considered was whether they understood the sources of error in the data being collected, and the potential for bias in the results.

If the actuaries had any concerns about the results of the chatbots, they should have considered their responsibility to speak up and raise this with the wider team, and escalate their concerns if necessary and appropriate.

It may be that the workings of the algorithms were not communicated in a transparent and open way to the consumers, leading to the complaint. Although the tailoring of the algorithms themselves are done by non-actuaries, the actuaries have a responsibility under the Communication principle of the Code, to take steps to ensure that any communication for which they are responsible or in which they have a significant involvement is accurate, not misleading and contains an appropriate level of information. Furthermore, if the actuaries are providing the work to the client (internally or externally) which is done within the UK geographic scope, then TAS 100 will apply if their work is based on actuarial principles.

2. The chatbot algorithms raise various ethical challenges and risks, including considering the potential impact of the results on the decisions made by consumers. It is important to consider the potential biases, errors and assumptions within the models, and what impact that may have on its results.

   The chatbot raises questions around what human oversight there is over the system given it produces automated results. It would be expected that the team considered how to monitor the algorithm over time and agreed in advance where responsibility lay. It would be prudent to keep such models under regular review for example, consider the potential implications the system had for consumers and test the results.

   If the data on which the chatbot was 'trained' on is in any way biased, it may carry that bias over to users of the system and potentially discriminate. There is a risk that a chatbot could have automatic misguided assumptions about a user, leading to it offering a wrong or limited product.

   Depending on the algorithm of the chatbot, there is a risk that from learning through conversations with various consumers/users, it could repeat potentially confidential information and/or the AI may not align with acceptable behaviours. This could be damaging for the company's reputation, as well as those on the team who have produced it. This may also ultimately impact on consumer trust of AI.

3. In order to mitigate against the risks, the company could in the first instance and at the start of the project, consider the ethics of using chatbots.

   Do they have the potential to cause harm to individuals? Has best professional practice been applied? Is there sufficient accountability and oversight?

   The company/team can put into place a process to cross-check the data and the answers being given to consumers. The company could have also run a limited pilot before full implementation where every result from the algorithm is tested. Any issues could then be fixed prior to full implementation. Further sample testing of the results could then be done before it is fully rolled out, to check if it is aligning to what they would expect.

4. A regulator would likely consider whether the company has complied with relevant regulations/legislation, as well as the spirit of the legislation. They might look for the company to be able to explain how the chatbot works, why it produces certain results and whether the results were repeatable. It might have concerns over whether consumers are being offered

fair and tailored products, appropriate to their needs, are not limited by the chatbot's offering and whether there was any potential discrimination occurring. A regulator might look to see if the company has minimised any potential unfairness with appropriate controls and testing.

CASE STUDY 2

You work as an in-house actuary for a life Insurance company. You have been placed in a new team comprising of actuaries and data scientists. Your team has developed an underwriting tool using machine learning which combines data from a range of public and proprietary sources to calculate the likelihood of potential customers carrying out risky activities that would affect their premium, and uses this to set a risk score for the customer.

Questions

1. What are the potential risks of this software?

2. What obligations as an actuary would you consider?

Discussion points

1. Such a system raises risks of unfairness against consumers by automatically assigning a risk score which is dependent on the data collected by the support tool. How can the company be sure that all of the data collected is free from bias? Has relevant permission been given by the data subjects to use their data in this way? Have the results been subject to rigorous controls and testing? Do they results demonstrate any potential bias?

2. IFoA Members have a responsibility to comply with the Actuaries' Code Competence and Care principle, which states that Members must ensure that they have an appropriate level of relevant knowledge and skill to carry out a piece of work and that they need to consider whether input is required from other professionals or specialists.

   For actuaries working within the geographic scope of the FRC TASs, TAS 100 requires that communications shall describe the data used in the technical actuarial work, the source of the data, the rationale for the selection of the data, whether checks and controls have been applied, any material uncertainty in the data, and the approach taken to deal with that uncertainty.

   TAS 100 also requires that models used in 'technical actuarial work' shall be fit for the purpose for which they are used and be subject to sufficient controls and testing so that users can rely on the resulting actuarial information.

   Under APS X2, Members must consider whether to apply work review to actuarial work for which they are responsible and to consider whether that review should take the form of independent peer review.

CASE STUDY 3

You're a junior member of an actuarial pricing team, reporting to the senior actuary about your latest pricing model, which implements machine learning algorithms using data from Internet of Things (IoT) devices. (Internet of Things is the name given to internet-connected sensors which collect data about objects or people. Examples include: monitoring whether a house is occupied, whether windows are open, pipes are leaking, or measuring a person's temperature, steps and heart rate.)

Your senior actuary observes that the pricing is now so granular that each person's individual risk characteristics can be priced based on their data from the IoT devices. This will mean that your prices can be more competitive for better risks, driving sales which in turn will boost profits and bonuses for company staff.

You point out that the product will work well for the "good risks" but will also mean extremely high prices for bad risks, pushing them out of the market, and those people may be the ones who need the insurance the most. You note that if pricing is too granular it seems to contradict the principle of pooling risks, which is the original foundation of insurance.

Question

What ethical and professional issues might be relevant to consider in this situation?

Discussion point

From the perspective of the modelling algorithm, the actuary should check that customers have consented for their data to be used in this way by the firm. They can also seek to ensure that the decision-makers and stakeholders understand the ethical risks of the model.

In terms of fairness from the firm's perspective, the actuary could consider what is driving the firm's growth in this market - is it just the desire for profits, or does it demonstrate that the products are successfully meeting customer needs? Does the firm understand the ethical principles and potential consequences? Could the firm engage with ethical bodies or stakeholder groups?

Thinking more widely, the actuary could consider whether there is effective competition in the insurance market so that customers still have a choice of provider? Are any particular segments of society more at risk of being excluded from insurance in this situation – such as the more vulnerable? If more vulnerable parts of society are negatively impacted, this could also affect public trust and confidence in AI, and raise public interest issues for the insurance market and actuarial profession.

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