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Letter to the Editor

Perspective on running a mathematical and computational ophthalmology seminar series

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Introduction

The application of quantitative techniques to ophthalmology and vision science has surged in the past decade, with the convergence of large clinical data sets, increased computing power, and artificial intelligence (AI) algorithms. Indeed, ophthalmology is leading the way in the clinical use of AI, supplying the "first fully autonomous AI system across any field of medicine to receive FDA clearance" to screen for diabetic retinopathy.[1,2]

Within the quantitative realm, a distinction can be made between *mathematical* and *computational* approaches to ophthalmology. As I define them, *mathematical ophthalmology*—a term which I have coined—involves the use of mechanistic (applied mathematical) modelling to explore the mechanisms underpinning ocular health and disease, while *computational ophthalmology*—an existing term—involves the use of AI to identify and predict the present and future state of the eye in a mechanism-independent manner. These approaches are complementary, each with their own strengths and weaknesses.

Those not familiar with these fields might be surprised to learn that the mathematical ophthalmology and computational ophthalmology communities function largely independently from one another. This separation may be attributed to a variety of factors, including divergent disciplinary origins (mathematics versus computer science), university departmental divisions, as well as participation in distinct professional societies, conferences, and journals. Indeed, when I share findings from one side of the mathematical/computational ophthalmology divide with those on the other, I am often met with a surprised "I

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didn't know they could do that!"

If those within the quantitative ophthalmology community are often unaware of what others in their field are doing, how much more so scientists who do not work in this field? It was with this in mind that I created the Mathematical and Computational Ophthalmology (MaCO) Seminar Series with the support of Professor David Crabb (City St George's, University of London) and Emeritus Professor Philip Luthert (University College London). This series aims to bring together the mathematical and computational communities working on applications that target the eye, while also raising awareness of the exciting research being conducted in these fields to the broader scientific and medical community.

The MaCO Seminar Series was inspired by the Baden Lab Sussex Vision Talks and follows a similar format. The Sussex Vision Talks started in 2020, following the onset of the COVID-19 pandemic, which saw a notable rise in online seminars. I was a member of Professor Baden's lab during that period, and hosted a talk with Professor E.J. Chichilnisky, providing valuable experience in creating my own series.

The MaCO Seminar Series can be accessed on YouTube via the following link: https://www.youtube.com/@MathCompOphth.

Vital statistics

The inaugural talk in the MaCO Seminar Series was given by Professor Emeritus Robert Linsenmeier on 7 February 2023. Since then, there have been a further 7 seminars, given by Professor Aaron Lee, Professor Anna Pandolfi, Dr. Tiarnán Keenan, Professor C. Ross Ethier, Professor Pearse Keane, Professor Giovanna Guidoboni, and Professor Christine Curcio (Fig. 1), with more talks to follow this year (2025), including from Professor Arto Urtti. As of 11 April 2025, the series YouTube channel has ~200 subscribers and over 3000 views. The most viewed seminar has ~700 views, the mean viewing number being ~370, while the most live views for a seminar was ~90, with a mean of ~55. Given that MaCO is a relatively small field, these are encouraging numbers.

Positive feedback

In addition to many positive comments on the individual talks, the series as a whole has been well received, with particular praise for the maintenance of seminars on YouTube as a permanent resource. Feedback includes the following anonymized comments: "I wish to express my enthusiasm for this wonderful initiative", "It's a great initiative", "I find it very attractive that you can look at this again and again on YouTube", "It is good that your lecture series is on YouTube so that I could see it although I missed the live session".

Fig. 1. Past talks in the MaCO Seminar Series. MaCO logo copyright of the author: Dr. Paul A. Roberts.

Variety is the spice of life

I seek to achieve a degree of variety across the seminars. This encompasses several dimensions. First, regarding methodology, a balance between mathematical (mechanistic) and computational (AI) approaches to ophthalmology is maintained, alternating between these where possible. The talks also cover a range of different approaches/techniques within these disciplines (*e.g.*, biochemical versus mechanical mechanistic models). Second, in terms of the application, talks cover a variety of anatomical regions, mechanisms, and pathologies of the eye. Third, regarding the speakers, these have come from a variety of disciplinary backgrounds, spanning mathematical, computational, engineering, experimental, and clinical scientists. I also aim for a representative mix of male and female speakers from a range of countries and institutions, though this is constrained by the current makeup of those working within the field.

Time is the fire in which we burn[3]

Seminars are held at irregular dates and times. This has several advantages. First, it makes it easier to secure speakers given that senior academics are generally busy, so have many constraints on when they are available to speak. Second, it reduces pressure on the organizer to arrange talks for specified dates. Third, it limits the problem where people in certain time zones are excluded from watching live. The disadvantage is that it is difficult for the audience to anticipate when the next talk will be, making it harder to build a regular audience.

Seminar length is kept to about an hour, with a 5-minute introduction, a 40–50-minute talk, and approximately 10 minutes for questions and answers. This is long enough to allow for an in-depth talk and discussion, while being compact enough to make it realistic for the audience to attend the full seminar amidst their busy schedules.

Behind the scenes

The series is advertised on platforms such as World Wide, Twitter/X, LinkedIn, YouTube, professional society and university mailing lists, and my personal website, together with various networks and personal contacts.

Where possible, a short technical run-through meeting is held with speakers a few days before their seminar. This allows one to work out any kinks ahead of time, ensuring that, on the day, the seminar runs smoothly and to schedule. I also meet with the speaker ~15 minutes before the seminar start time to get set up and check everything is working correctly.

Seminars are held over Zoom and livestreamed to YouTube. As such, only the speaker and I are in the Zoom meeting. This makes for a cleaner production than the format where the audience joins the Zoom meeting and avoids noise from unmuted audience members.

Recordings are maintained on the MaCO YouTube channel, creating a permanent, open-access resource for current and future generations to draw upon (a feature particularly praised by viewers; see ‘Positive feedback’ above).

Speakers are asked to make their talks accessible to a wide audience, since some listeners (on the quantitative side) will not have a detailed knowledge of the eye and others (from the experimental/clinical side) will not have a detailed understanding of the relevant quantitative methods (mechanistic modelling and/or AI).

Audience members are invited to type their questions into the YouTube chat during and after the talk. I then collect these questions in a Google Doc, shared with the speaker, allowing them to view them and to highlight any they think would be particularly interesting to discuss. This approach has the advantage that questions can be submitted at any time during the talk without interrupting the speaker and

that they can be gathered in a logical order to present to the speaker as soon as the talk is finished. Further, audience members must be logged in with an appropriate account to be able to post a question to the chat, ensuring that only legitimate participants can contribute.

Conclusion

It is an exciting time to be working in MaCO. Despite being a fast-growing area, it remains in its infancy, with much further work required for the field to reach its full potential. Aiding in this endeavor, the MaCO Seminar Series showcases the current state-of-the-art from leading figures in the field, raising MaCO's profile, while encouraging future work in this area.

Looking to the future, it is hoped that the MaCO Seminar Series will continue for many years to come. In so doing, it will be important to maintain the present strengths of the series, showcasing a diverse range of speakers across disciplines, applications, and institutions, and bringing the mathematical ophthalmology and computational ophthalmology communities together.

Building on these strengths, the intention is to extend the scope of the series. For example, hosting talks from experimentalists and clinicians, describing areas that could be addressed by quantitative approaches (Christine Curcio's 2024 talk[4] was an excellent example of this). A further aim is to host more talks from people who combine mathematical (mechanistic) and computational (AI) approaches. Only a few researchers are doing this at present; however, there is great potential in combining these approaches, given their complementary strengths in providing mechanistic insight (mathematical) and predictive power (AI).

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