1. What inspired this study?
First, a brief sketch of my imaging research backdrop. I got into brain imaging in 2009. I got involved in studying meditation effects on brain images in 2012. I started working on developing novel methods that can reveal the effects of meditation (and other conditions) on brain imaging. I worked on extending standard regression methods to complicated objects beyond real numbers such as diffusion tensors, probability distributions, deformation tensors.

I was brought on to YMR's study in 2016. At the time I didn't know about the so called BrainAGE. When Richie pointed me to a paper and asked if I could apply that method to YMR's data, I dove into the papers and found a really exciting twist in interpreting the behavior of machine learning models. Typically, when a machine learning model in computer vision say built for a task of differentiating roses from lilies makes an error in prediction, we attribute it to the insufficiency of the model. But, in the case of predicting calendar age from brain images which pretty much look the same in most cases, we put more faith in the model and reinterpret its prediction error as the gap between the actual biological brain age and the calendar age. Then we can infer the biological age of the brain by simply adding the gap to the calendar age. This was a revelation to me, and I jumped at the opportunity to thoroughly analyze the data and see what the "machine model" had to say about a set of brain images of a top Buddhist monk collected over a decade. Another subtle but persistent motivation was that the data, with his first scan being in 2002 one year before I entered the United States, seemed like a buried treasure chest that somehow, I got a lucky chance to dig into.

2. Why study Buddhist monks and not some other person?
I am not a Buddhism expert but based on what I know about Buddhism, it is in the vanguard of embracing symbiosis between religion and science. For example, in his latest book, Brian Greene, a professor math and physics at Columbia, recalls about his interaction a long time ago with the Dalai Lama where he said something to the effect that 'Buddhism might have something to say on consciousness but on knowledge about matter and materials modern science is where we have to look'. Given such inclination, its 2500 years history of enigmatic traditions and practices for overcoming suffering, I think it becomes natural for someone interested deeply in alleviating suffering and improving well-being to study practices, behaviors and individuals from Buddhism.

Good thing is that the techniques we used in this paper are not restricted to be applied just to Buddhist monks. It could be applied to any specific population of interest. We also released our code to aid researchers in pursing such efforts.

3. Does this mean that meditation can make your brain age more slowly?
The notion of brain age is very specific here. It is derived by putting faith in a robust machine learning model applied to a brain image. What this paper shows is when using a specific machine learning model (relevance vector machine) the predicted brain age falls behind by 0.45 year per calendar year for the monk compared to the control group. Given the approximate nature of MRI probes of the brain, the limited universality of the machine learning models and lack of fully matched controls, these results certainly need to be tested with independent datasets, imaging techniques and machine learning models before definitively concluding that meditation slows brain aging.

4. What can people do on a daily basis to get similar effects?
This is a very good question and it is hard to decipher from this paper alone the specifics of activities that can achieve similar effects. But if we take these findings in the larger context of meditation research which lists different types of benefits, one can expect that consistent practice of meditation for extended periods of time would be able to produce similar effects. To

conclusively demonstrate this, we would need to carefully design studies that can probe the effects of prolonged mindfulness practice spanning over years or even decades.

5. What other research is being done moving forward?
At the moment, I am not entirely sure if there are plans to recruit monks with similar life experience for further studies. But I believe there are a lot of interesting activities going on at the center and I am hopeful that there will be more such datasets that can be analyzed to hone more into the unique effects of consistent and persistent meditation.