STATEMENT OF CONTRIBUTION: RESEARCH

ANAND DEOPURKAR

I am a mathematician specialising in **algebraic geometry**. Algebraic geometry is fundamental in pure mathematics and has manifold applications to mathematical physics, computer science, mathematical biology, statistics, optimisation, engineering, to name a few. It is a highly active area of current research. Of the seven "million dollar" open problems in mathematics, two are questions in algebraic geometry and a third is closely related.

The focus of my research is the study of **moduli spaces** in algebraic geometry. These are geometric constructs used to study whole collections of mathematical objects *at once*, and therefore, have enormous importance and impact. My work has shed light on some of the most intensely studied moduli spaces, namely the **moduli spaces of Riemann surfaces**, and several related spaces important in algebraic geometry, dynamics, mathematical physics, and number theory.

With a creative blend of modern tools and classical geometric intuition, I have **solved long-standing open questions**. My paper titled "The canonical syzygy conjecture for ribbons" proves a conjecture of Eisenbud and Bayer from the 1990s. My paper "Vector bundles and finite covers" (with Anand Patel) answers the geometric case of a classic open problem in number theory. My paper "Toward GIT stability of syzygies of canonical curves" (with Maksym Fedorchuk and David Swinarski) revitalises a decades old research program.

My strong track record and upward trajectory are evidenced by the expert feedback on my ARC proposals. ARC expert assessors write that I am a **"first rate algebraic geometer"** with an **"impressive list of high quality results"**, and a **"leading expert"** with a **"rising trajectory"**.

Since joining the ANU, I have broadened my research focus to undertake joint projects where my expertise plays a crucial role. Asilata Bapat, Anthony Licata, and I have embarked on an ambitious project that uses category theory to apply geometric techniques to algebra. We have already written a pre-print (with more in preparation) and have given invited talks in conferences. With James Borger and Uri Onn, I have initiated a program to use algebraic geometry to understand representations of arithmetic groups. Although in early stages, my program has already been successful in settling an open question of Uri Onn and his collaborators, and has opened new directions of research.

Research outputs. I have written **10 peer-reviewed articles** and **4 pre-prints**. I am either the sole author of these articles or a part of a small team consisting of two or three authors. My papers have appeared in **top-rated journals** in pure mathematics. For example, of my articles, three have appeared in journals which are in the **top-most tier (A*) according to the Australian Mathematical Society** (AustMS) and which are **ranked 2nd and 3rd in *Algebra* by Google Scholar**.

Research funding. I have successfuly secured a **DECRA ($328,075, 2018–2021)** for my projects about moduli spaces in algebraic geometry. I have secured funding to organise international conferences: one at the American Institute of Mathematics in California (with Fedorchuk, Morrison, and Wang) and one at the Banff International Research Center, Mexico (with Alper and Lozano Huerta).

Peer recognition. I have **given invited talks at international conferences** in Sydney, Auckland, Xiamen (China), Chapel Hill (USA), Providence (USA), Daejeon (S. Korea), Jeju (S. Korea), and Postech (S. Korea). I have been invited to invitation-only workshops at international research centers, like the Banff International Research Center in Canada, the Mathematische Forschungsinstitut in Oberwolfach in Germany, and the American Institute for Mathematics in USA. I have given many invited talks in departmental seminars, including at Harvard, MIT, Yale, Princeton, Stanford, Michigan, UC San Diego, Columbia, and NYU. All of the talks and research visits listed above were funded fully or substantially by the organisers.

Research training. In my short tenure at the ANU, I have supervised **two masters students** (one solo and one joint), and **two honours students** (joint). I am currently supervising three more honours students, two of whom are joint with researchers outside MSI (ASD and RSCS). I have supervised three shorter term (6 weeks) research students. I **played a substantial role as a mentor in the PhD project** of Changho Han at Harvard (currently a post-doc at the University of Georgia). His thesis work builds on a research proposal I formulated, and will appear as a joint paper.

Professional service and leadership. I have been an **expert assessor for ARC Discovery Projects** for 1 year. I have **refereed for several top international journals** in mathematics. With a small team of colleagues, I have organised multiple international research workshops at leading research centers.