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EDUCATION IN
MATHEMATICS

Applications of Algebraic Topology
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My summer scholarship involved studying algebraic topology and its application to shape recognition at the Australian National University, under the supervision of Prof. Amnon Neeman.

The first part of the scholarship consisted of lectures by Prof. Neeman, each of which showed an interesting link between different areas of mathematics. The first was about the elliptic equation and the Weierstrass P function, the second was showing the use of analysis in proving that there is an infinite number of primes congruent to 1 modulo 4, and the third was an introduction to Lie groups.

As I have not studied algebraic topology before, the second part of my project involved learning some background from Allen Hatcher's Algebraic Topology. The topics covered included the fundamental group, simplicial and singular homology, the formal axioms for homology, and an introduction to cohomology and the cup product.

The third part involved researching how algebraic topology is used in point cloud data and shape recognition, studying the work of the "Topological Methods in Scientific Computing, Statistics and Computer Science" research group at Stanford University on persistence homology and barcode shape descriptors. Finally, I employed some of their techniques in investigating my own invariant, the homology of the complex built by considering the intersection of the space with the Grassmannian.

During my time at ANU I have learnt not only a lot of mathematics, but also a lot about research, and am very grateful for this very enjoyable experience.