# Yousuf Tufail

Applied Mathematician, Data Scientist

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## Personal Statement

I am an applied mathematician with a deep interest in mathematical and statistical modelling. My area of PhD was image registration using conformal diffeomorphisms. I have developed two alternative algorithms for the construction of conformal diffeomorphisms. These algorithms were implemented on grey scale 2-D images. My additional skills include machine learning, data mining, web scraping, bootstrapping, hypothesis testing (ex: A/B test), relational databases, predictive analytics, and deep learning with strong programming skills in MatLab, Python, SQL, SAS files, STATA files, LaTeX, R and Excel.

## Career History

- October 2025–Present **Associate Professor**, *Department of Mathematics*, NED University of Engineering and Technology, Karachi, Pakistan
- January 2020–October 2025 **Assistant Professor**, *Department of Mathematics*, NED University of Engineering and Technology, Karachi, Pakistan
- July 2006–January 2020 **Lecturer**, *Department of Mathematics*, NED University of Engineering and Technology, Karachi, Pakistan
- January 2005–June 2006 **Lecturer**, *Department of Mathematics*, University of Karachi, Karachi, Pakistan

## Education

### Academic Qualifications

- 2012–2017 **PhD in Mathematics**, Massey University, Palmerston North, New Zealand
  Image registration under conformal diffeomorphisms
  `https://mro.massey.ac.nz/handle/10179/12459`
- 2004–2005 **MSc in Mathematics**, University of Karachi, Karachi, Pakistan
- 2001–2003 **BSc (Hons) in Mathematics**, University of Karachi, Karachi, Pakistan

### Certification

- 2021 **Data Science with python**, DataCamp, https://www.datacamp.com/
- 2020 **Data Visualization, Matplotlib**, DataCamp, https://www.datacamp.com/
- 2020 **Data Visualization, Seaborn**, DataCamp, https://www.datacamp.com/
- 2020 **Data cleaning in Python**, DataCamp, https://www.datacamp.com/
- 2019 **Supervised learning**, DataCamp, https://www.datacamp.com/
- 2019 **Unsupervised learning**, DataCamp, https://www.datacamp.com/
- 2019 **Deep learning in python**, DataCamp, https://www.datacamp.com/

- 2018–2019 **Python programmer**, DataCamp, https://www.datacamp.com/
- 2018–2019 **Data manipulation**, DataCamp, https://www.datacamp.com/
- 2018–2019 **Importing & Cleaning data**, DataCamp, https://www.datacamp.com/
- 2018–2019 **Statistical Thinking in python**, DataCamp, https://www.datacamp.com/
- 2018–2019 **Relational databases**, DataCamp, https://www.datacamp.com/

## Trainings

- Development of Self Assessment Report (SAR) as per HEC
- Leader Ship Development Programme (QEC)
- Teaching Excellency Framework (QEC)

## Notable Achievements

- 2025–present **NED approved PhD supervisor**, NEDUET, Karachi.
- 2021–2024 **HEC approved PhD supervisor**, HEC, Islamabad.
- 2012–2017 **Marsden Fund**, Massey University, Palmerston North, New Zealand
  On the basis of my excellent academic record, I was awarded a highly competitive PhD scholarship by the Massey University. This scholarship was awarded from the Royal Society of New Zealand Marsden Fund, Te Apārangi.
- 2011 (Refused) **Cinvestav**, Cinvestav, Mexico City, Mexico
  I was awarded fully funded PhD scholarship to pursue my PhD in the Departamento de Matemáticas at Cinvestav.
- 2011 (Refused) **NED University Scholarship**, TU Delft, Delft, Netherlands
  I was awarded a PhD scholarship to pursue my PhD at TU Delft.
- 2011 (Refused) **University of East Anglia**, University of East Anglia, Norwich, England
  I was awarded a 20% PhD scholarship to pursue my PhD at the University of East Anglia.
- 2005 **Second Position (Rank)**, University of Karachi, Karachi, Pakistan
  I ranked second position in my MSc.

## Taught Courses

During my teaching career I have been involved as a course coordinator in variety of courses such as:

- Calculus
- Linear Algebra
- Ordinary Differential Equations
- Introduction to Integral Transforms (Fourier and Laplace)
- Graph Theory
- Discrete Mathematics
- Abstract Algebra
- Galois Theory
- Higher-Order and Partial Differential Equations (Heat, Wave, and Laplace Equations)
- Introduction to Basic Statistics and Probability
- Discrete and Continuous Probability Distributions (Binomial, Poisson, Hypergeometric, Geometric, Gamma, Exponential, and Normal)
- Estimation Theory, Hypothesis Testing, and ANOVA
- Programming for Data Scientist (Python)
- Scientific Computing: MatLab-based course

## Supervision

1. **PhD supervision:**

| Year | Thesis Title | Capacity | Candidate | Outcome |
|---|---|---|---|---|
| 2026 | Mathematical exploration of climate variability over South Asian countries using generalized linear model | Supervisor | Muhammad Haris Ur Rehman | In Progress (Expected to submit in 2026) |
| 2026 | A Mathematical Framework for Predictive Modeling of High-Water Levels in Sindh | Supervisor | Aamir | In Progress (Expected to submit in 2027) |

2. **MS-Supervision:**

| Year | Thesis Title | Capacity | Candidate | Outcome |
|---|---|---|---|---|
| 2026 | Early Alzheimer's detection using Centrality in Brain Network Graphs | Supervisor | Madiha Ahmed | In Progress |
| 2025 | Comparative study of Modified RSA Algorithms for Key security | Co-supervisor | Sameer Khalid | Completed |
| 2025 | Comparing Artificial Intelligence and Fuzzy Learning for the Prediction of Cardiovascular Disease | Supervisor | Maham Fahim | Completed |
| 2025 | Brain Stroke Prediction: An Artificial Intelligence-Based Risk Assessment Model | Co-supervisor | Hafiz Syed Muhammad Kashif | Completed |
| 2024 | Spatial and Temporal Analysis of Rainfall | Supervisor | Muhammad Hunain Anwar | Completed |
| 2023 | Solution to a Functional Differential Equation Arising in the Cell Growth Model | Supervisor | Iqra Nawaz | Completed |
| 2023 | A Study on Analytic Solution to a Functional Differential Equation Arising in a Cell Growth Model | Co-supervisor | Bushra Rais | Completed |
| 2022 | Comparison of Rigid Registration with Different Optimisation Techniques | Supervisor | Aizaz Hussain | Completed |
| 2022 | Comparison of Rigid Registration with Different Objective Functions | Supervisor | Farzana Yasmeen | Completed |

## Funding

I have applied for several research funding opportunities. Details are provided in the table below.

| Title | Funding agency | Amount | Year | Decision |
|---|---|---|---|---|
| Modelling and Forecasting Climate Variables Across Sindh | Sindh Research Support Program SRSP | 5 Millions | 2025 | In progress |
| Modelling and Forecasting Climate Variables Across Pakistan | National Research Program for Universities NRPU | N/A in phase 1 | 2025 | In progress |
| Simulation and Forecasting for rainfall and other climate variables | Sindh HEC | $\approx$ 5 Millions | 2023 | Rejected |
| Future projection of natural climate variables using general circulation models (GCM) | Challenge driven Innovation Fund IGNITE | $\approx$ 23 Millions | 2022 | Rejected |

## Publications and Conferences

### Published journal articles

IMAGE REGISTRATION

- 2025 **S. Marsland, R. I. McLachlan and M. Y. Tufail. Unconstrained optimisation for conformal diffeomorphic image registration**, *Accepted for Bulletin of the Korean Mathematical Society, ISSN: 1015-8634, 2234-3016*, JCR indexed Journal

- 2025 **M. Y. Tufail and S. Gul. An optimisation over the Möbius group for an optimal solution in image registration.**, *Punjab University Journal of Mathematics, pp: 670–686, vol: 57 (06), 2025, https://doi.org/10.52280/pujm.2025.57(06)04, ISSN: 1016-2526*, JCR indexed Journal.

- 2025 **M. Y. Tufail and S. Gul. Conformal pattern in the growth of human skulls**, *Acta Biotheoretica, vol: 73 (13), 2025, https://doi.org/10.1007/s10441-025-09503-6, ISSN: 1572-8358, 0001-5342*, JCR indexed journal.

- 2025 **M. Y. Tufail, S. Gul. Conformal image registration using the discretised Cauchy-Riemann equations**, *The ANZIAM Journal, 2025, https://doi.org/10.1017/S144618112500001X, ISSN: 1446-1811,1446-8735*, JCR indexed Journal

- 2023 **M. Y. Tufail and S. Gul. Image registration using the rigid group**, *Scientific Inquiry and Review (SIR), pp: 71–86, vol: 7 (1), 2023, https://doi.org/10.32350/sir.71.05, ISSN: 2521-2435, 2521-2427*, HEC recognised Journal

2021 **S. Marsland, R. I. McLachlan and M. Y. Tufail. Conformal image registration based on constrained optimization**, *The ANZIAM Journal, pp: 235–255, vol: 62 (3), 2021, https://doi.org/10.1017/S144618112000022X, ISSN: 1446-1811,1446-8735*, JCR indexed Journal

Climatology and Data Science

2025 **M. Y. Tufail, S. Gul. Comprehensive comparison between artificial intelligence and multiple regression: prediction of Palmerston North's temperature**, *Discover Sustainability, pp:1–22, vol: 6 (1), 2025, https://doi.org/10.1007/s43621-024-00745-x, ISSN: 2662-9984*, JCR indexed Journal

2025 **M. Y. Tufail, S. Gul, S. Ali, S. S. S. Zia, S. A. Ali. The Influence of characteristics of the Azores High on surface climate: A case study for Peninsular Spain**, *Journal of Environmental Engineering and Science, pp: 49–57, vol: 20 (1), 2025, https://doi.org/10.1680/jenes.24.00035, ISSN: 1496-256X,1496-2551*, JCR indexed journal

2024 **M. Y. Tufail and S. Gul. Artificial intelligence and statistical regression for the prediction of temperature over Sukkur region**, *International Journal of Artificial Intelligence & Mathematical Sciences, pp: 50–61, vol: 3 (2), 2024, https://doi.org/10.58921/ijaims.v3i2.125, ISSN: 2958-0153, 2958-5228*, HEC recognised Journal

2024 **M. Y. Tufail, S. Gul, L. Jaben, S. Rasheed and S. Zia. A multiregressed COA-SAM model for predicting seasonal streamflow variability: A case study over Murray River Basin**, *Global NEST Journal, PP: 1–9, vol: 26 (3), 2024, https://doi.org/10.30955/gnj.005329, ISSN: 1790-7632*, JCR indexed Journal

2022 **M. Y. Tufail and S. Gul. Statistical analysis for the traffic police activity: Nashville, Tennessee, USA**, *KIET Journal of Computing and Information Sciences (KJCIS), pp: 67–84, vol: 5 (3), 2022, https://doi.org/10.51153/kjcis.v5i2.135, ISSN: 2616-9592, 2710-5075*, HEC recognised Journal

2008 **M Y Tufail, S. U. Rehman, B. A. Usmani. Modeling and simulation of summer monsoon rainfall for Northern Hilly Area of Pakistan**, *Proceedings of IEEE, pp: 480–484, 2008, https://doi.org/10.1109/INMIC.2008.4777786*

## Mathematical Education

2026 **M. Y. Tufail, S. Gul, S. A. A. Hashmi. Interactive MatLab GUI for exploring extreme values in bivariate functions**, *Revista Mexicana de Física E, pp: 1–6, vol: 23 (1), 2026,* `https://doi.org/10.31349/RevMexFisE.23.010212`, *ISSN: 2683-2216*, ISI, Scopus indexed journal

2025 **A. Razzak, M. Y. Tufail, A. Tahir, M. Adeel. Simulation of wind speed distribution through spreadsheets**, *Jurnal Pendidikan Fisika Indonesia, pp: 170–178, vol: 21(2), 2025,* `https://doi.org/10.15294/jpfi.v21i2.1836`, *ISSN: 1693-1246, 2355-3812*, JCR indexed Journal

2025 **M. Y. Tufail, S. Gul. GUI of complex plane on Excel spreadsheets**, *Revista Mexicana de Física E, pp: 1–3, vol: 22 (1), 2025,* `https://doi.org/10.31349/RevMexFisE.22.010208`, *ISSN: 2683-2216*, ISI, Scopus indexed journal

2024 **S. Gul, M. Y. Tufail. GUI for conic sections: parabola, ellipse and hyperbola**, *Revista Mexicana de Física E, pp: 1–5, vol: 21 (1), 2024,* `https://doi.org/10.31349/RevMexFisE.21.010203`, *ISSN: 2683-2216*, ISI, Scopus indexed journal, ISI, Scopus indexed journal

### Submitted journal articles

2026 **M. Y. Tufail, S. Gul. Fuzzy Probabilistic Learning for Thyroid Hormonal Imbalance Detection**, *submitted to IEEE Journal of Biomedical and Health Informatics, 2026, ISSN: 2168-2194*, JCR indexed Journal, Under review

2024 **M. Y. Tufail, S. Gul. Prediction for the precipitation (rainfall) of Sukkur region using artificial neural network, multiple regression and supervised machine learning**, *submitted to Mindanao Journal of Science and Technology, ISSN: 2244-0410, 2449-3686*, JCR indexed Journal, Under review

2025 **M. Y. Tufail, S. Gul. Harmonic constraint for conformal image registration**, *submitted to Bulletin of the Korean Mathematical Society, ISSN: 1015-8634, 2234-3016*, JCR indexed Journal, Under review

### Conferences

2023 **Research Colloquia 2023 (29 - 30 May)**, *Department of Mathematical Sciences, Institute of Business Administration*, Pakistan

- 2016 **Mathematics of Shapes and Applications (4 - 31 July)**, *Institute for Mathematical Sciences, National University of Singapore*, Singapore
- 2016 **ANZIAM2016 Conference (7 - 11 February)**, *QT Hotel Canberra*, Canberra, Australia
- 2015 **Mathematics-in-Industry NZ (MINZ) (29 June - 03 July)**, *Atrium Building, Massey University, Albany*, Auckland, New Zealand
- 2014 **Foxton Fizz: Workshop on Geometry and Numerics (11 - 14 February)**, *Foxton*, Palmerston North, New Zealand
- 2013 **NZMASP2013 (11 - 14 November)**, *University of Canterbury Cass field station*, Christchurch, New Zealand
- 2013 **Geometric Mechanics and Shape (13 - 19 January)**, *Ohope Beach*, Whakatane, New Zealand
- 2012 **NZMS Colloquium (4 - 6 December)**, *AgHort building, Massey University*, Palmerston North, New Zealand
- 2012 **Winterschule in Numerical Differential Equations (7 - 8 May)**, *Business Studies Central, Massey University*, Palmerston North, New Zealand

## Leading real data set projects

### Analyzing police activity

It is a data set of traffic stop by police officers in Rhode Island, USA. Data set was taken from Stanford open policing project `https://openpolicing.stanford.edu`. Finding are as below:

- About two-thirds of female traffic stops are for speeding, whereas stops of males are more balanced among the six categories of violation. About 95 % of stops for speeding result in a ticket and the numbers are similar for males and females.
- For all types of violations, the search rate is higher for males than for females.
- The frisk rate is higher for males than for females and the rate of drug-related stops nearly doubled over the course of 10 years
- The arrest rate increases as the weather gets worse, and that trend persists across many of the violation types.

### Life expectancy around the world

I have investigated the probabilities of life expectancy in countries around the world. The data set was obtained from `https://docs.google.com/spreadsheets/d/1dgOdlUEq6_V55OHZCxz5BG_0uoghJTeA6f83br5peNs/pub?range=A1:D70&gid=1&output=html#`. Finding is as under.

- It looks like overall, life expectancy has steadily increased since 1900.

### Relation between illiteracy and fertility

The women population data was collected from the link `https://www.datacamp.com/courses/statistical-thinking-in-python-part-2`.

- My analysis found that illiterate female has more children than the number of birth given by literate women.

### Real estate data set, a machine learning algorithm

The data is collected from Airbnb site, a marketplace for short term rentals. The link is: `http://insideairbnb.com/get-the-data.html`. I have used k-nearest neighbors algorithm to built a python based program. This program helps to find the suitable cost of living space. Two data sets: Amsterdam and Washington, DC were considered.

### GDP growth rate between USA and China

This data contains the information of Gross Domestic Product (GDP) and it was taken from `https://www.datacamp.com/courses/merging-dataframes-with-pandas`. Finding is:

- 10 year GDP growth of China has been higher than the US since the 2000s

### Medals counts

The Olympic medals data set (more than a century data points) is collected from `https://www.theguardian.com/sport/datablog/2012/jun/25/olympic-medal-winner-list-data`. The findings about this data are as below:

- The Olympic competitions between 1952 and 1988 took place during the height of the Cold War between the United States of America (USA) & the Union of Soviet Socialist Republics (USSR). I have found that the USSR is higher than the US on a medals table.
- On looking at the hosting countries from the last 5 Olympic editions and the fractional change of medals won by China the last 5 editions, I have found that China fared significantly better when China was the host country.

## Trainings

- Development of Self Assessment Report (SAR) as per HEC
- Leader Ship Development Programme (QEC)
- Teaching Excellency Framework (QEC)

## References


1. **Professor. Dr. Stephen Marsland** (PhD supervisor)
   School of Mathematics and Statistics
   Victoria University of Wellington
   stephen.marsland@vuw.ac.nz

2. **Distinguished Professor. Dr. Robert McLachlan** (PhD supervisor (co))
   School of Mathematical and Computational Sciences
   Massey University, Palmerston North
   r.mclachlan@massey.ac.nz

3. **Dr. Khuram Kamran** (Teacher and Ex-Colleague)
   Department of Mathematics
   The University of Melbourne
   kkamran@unimelb.edu.au