Sayantan Majumdar

Personal Information

name: **Sayantan Majumdar**
: emailmajumdarsayantan[at]gmail.com
: sayantanmajumdar.github.io
: 0009-0004-9222-5991
: Tripura, India.

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Research Experience

My current graduate research involves the analysis of continuous glucose monitoring (CGM) traces obtained from type 1 diabetes (T1D) and type 2 diabetes (T2D) patients within the Indian population. These traces are essentially discrete sequences of interstitial fluid glucose concentration (ISF) measurements. My research involved constructing a method for estimating the Glycated Hemoglobin (HbA1c) of the patient from their CGM trace and obtaining an estimate of their continuous blood glucose concentration (BG) curve. Fundamentally these problems lie at the intersection of `Optimization Theory`, `Control Theory`, `Inverse Theory`, `Dynamic Input Recovery`, `Dynamical Systems Theory`, and `Trajectory Optimization`.

I have successfully constructed two methods for estimating HbA1c values for Indian T2D patients from their CGM trace. This work has been published in "Evaluation of HbA1c from CGM traces in an Indian population", Majumdar et al. (2023). I have also analyzed these two methods of HbA1c estimation on CGM traces of T1D patients from the Indian population. My colleagues and I and have also developed a method, based on trajectory optimization, to obtain an estimate of the continuous BG from a patient's CGM trace. The latter two research work has been provided in my thesis "Analysis of Continuous Glucose Monitoring in relation to HbA1c and Interstitial Fluid Glucose", Majumdar (2024) and two manuscripts are currently under preparation for submission to a suitable journal.

The methods that were developed in my doctoral research have all been implemented in a MATLAB web application, named `CGM Analyzer (Versions: 0.2 and 2.0)`. This was done so that anyone can upload their CGM trace and get estimates of their HbA1c and the corresponding continuous BG curve.

Scholarship & Fellowships

1. **INSPIRE Fellowship**
   Description: A fellowship for students pursuing full-time doctoral (Ph.D.) Program.

2. **INSPIRE Scholarship**
   Description: A scholarship for students undertaking Bachelor and Masters level education in natural sciences.

Education

Ph.D. Institute: **Indian Institute of Science Education and Research Pune**
Period: 2018—2025
*(awaiting degree certificate, provisional degree certificate available)
Department: Department of Biology
Thesis: *Analysis of Continuous Glucose Monitoring in relation to HbA1c and Interstitial Fluid Glucose*
Thesis advisor: Pranay Goel
Date of thesis defence: 16th December, 2024
CGPA: 6.8

BSMS Institute: **Indian Institute of Science Education and Research Kolkata**
Period: 2013—2018
Department: Department of Physical Sciences
Thesis: *Investigation of Nonlinearities in Quantum Systems*
Thesis advisor: Soumitro Banerjee
CGPA: 7.58

ISC Insitute: **Holy Cross School, Agartala**
Year: 2013
Average score: 89.2 %

ICSE Insitute: **Holy Cross School, Agartala**
Year: 2011
Average score: 92.5 %

Work Experience

**(certificates or documents as proof of work can be made available upon request)*

1. **Teaching assistant**
   Institute: Indian Institute of Science Education and Research Pune
   Course: BIO310—Biostatistics
   Semester: January 2021 (January, 2021 — May, 2021)

2. **Teaching assistant**
   Institute: Indian Institute of Science Education and Research Pune
   Course: BIO451—Data Science
   Semester: January 2020 (January, 2020 — May, 2020)

3. **Teaching assistant**
   Institute: Indian Institute of Science Education and Research Pune
   Course: BIO201—Introductory Biology III - Ecology & Evolution
   Semester: August 2019 (August, 2019 — December, 2019)

4. **Teaching assistant**
   Institute: Indian Institute of Science Education and Research Kolkata
   Course: CS1101—Introduction to Computer Programming I
   Semester: Autumn 2017 (August, 2017 — December, 2017)

Technical Skills

Programming Languages

C ..... *Advanced* .....
C++ ..... *Intermediate to Advanced* .....
Fortran ..... *Intermediate* .....
Rust ..... *Intermediate* .....
Go ..... *Intermediate* .....
Python ..... *Advanced* .....
Matlab ..... *Advanced* .....
R ..... *Advanced* .....
Haskell ..... *Beginner* .....
Java ..... *Intermediate* .....

Markup and Web Scripting Languages

HTML ..... *Intermediate to Advanced* .....
CSS/SCSS ..... *Intermediate* .....
JavaScript ..... *Beginner* .....
TypeScript ..... *Beginner* .....

Typesetting and Documentation

LaTeX ..... *Advanced* .....

Proof Assistants

Coq ..... *Beginner to Intermediate* .....
Lean ..... *Beginner to Intermediate* .....

Querying Languages

SQL (PostgreSQL) ..... *Intermediate* .....

Build Systems

CMake ..... *Advanced* .....
Make ..... *Advanced* .....
Bazel ..... *Beginner to Intermediate* .....

Other Frameworks and Tools

Hugo ..... *Intermediate* .....
Git ..... *Advanced* .....
Jekyll ..... *Intermediate* .....

Publications

Papers

1. Sayantan Majumdar et al. "Evaluation of HbA1c from CGM traces in an Indian population". In: *Frontiers in Endocrinology* 14 (2023). ISSN: 1664-2392. DOI: 10.3389/fendo.2023.1264072. URL: https://www.frontiersin.org/journals/endocrinology/articles/10.3389/fendo.2023.1264072

Thesis

1. Sayantan Majumdar. "Analysis of Continuous Glucose Monitoring in relation to HbA1c and Interstitial Fluid Glucose". PhD thesis. Indian Institute of Science Education and Research Pune, Dec. 2024. URL: http://dr.iiserpune.ac.in:8080/xmlui/handle/123456789/9242

2. Sayantan Majumdar. "Investigation of Nonlinearities in Quantum Systems". BSMS thesis. Indian Institute of Science Education and Research Kolkata, 2018. URL: http://eprints.iiserkol.ac.in/id/eprint/796

Conference Posters and Presentations

1. Sayantan Majumdar et al. "A Comparison of algebraic and dynamic models to estimate blood glucose and A1C from CGM time series". In: *Diabetes Technology & Therapeutics*. Vol. 25. S2. E-poster at the Advanced Technologies & Treatments for Diabetes (ATTD) Conference 2023, Berlin & Online. Mary Ann Liebert, Inc., publishers, Feb. 2023, A-158 - A–158. DOI: 10.1089/dia.2023.2525.abstracts

2. Sayantan Majumdar et al. *How to track blood glucose from the CGM?*. Presentation at the 7th International Diabetes Summit - 2023 (IDS), Pune. Mar. 2023

Papers under preparation

1. Sayantan Majumdar et al. "Estimating Blood Glucose from Continuous Glucose Monitoring Traces". (paper under preparation)

2. Sayantan Majumdar et al. "Estimating HbA1c from CGM traces of T1D patients". (paper under preparation)

Software Packages, WebApps, and Apps Released

1. **CGM Analyzer**: A Web Application to analyze Continuous Glucose Monitoring (CGM) traces and provide an estimate of the Blood Glucose Concentration (BG) from the Interstitial Fluid Glucose Concentration (ISF).
   Versions released: 0.2 and 2.0
   URL: https://digimed.acads.iiserpune.ac.in/fgm-tools
   **(The WebApp is hosted on a local server which may be offline for various technical reasons. Please contact me if you need to access the WebApp and you find server is offline.)*

Languages

1. **English** — Full professional proficiency
2. **Bengali** — Native or bilingual proficiency
3. **Hindi** — Limited working proficiency

Coursework

*(transcripts can be made available upon request)

Ph.D.

Institute: **Indian Institute of Science Education and Research Pune**

Subject	**Grade**	**Total Credits**
BIO610 — Biostatistics	C	4.0
BIO631 — Literature Review	B	4.0
BIO637 — Bioinformatics	B	4.0
BIO668 — Neurobiology I	D	4.0
ECS651 — Digital Signal Analysis and Inverse Theory	B	4.0
(`Grade Values: A ≡ 10.0, B ≡ 8.0, C ≡ 6.0, D ≡ 4.0`)		C.G.P.A = 6.8

BSMS

Institute: **Indian Institute of Science Education and Research Kolkata**

Semester I — Autumn 2013

Subject	**Grade**	**Total Credits**
CH1101 — Elements of Chemistry	D	3.0
CH1102 — Chemistry Laboratory I	A	3.0
CS1101 — Computer Science I	A	3.0
ES1101 — Earth and Planetary Sciences	C	3.0
LS1101 — Introduction to Biology I	C	3.0
LS1102 — Biology Laboratory I	A+	3.0
MA1101 — Mathematics I	B+	3.0
PH1101 — Physics I	A	3.0
PH1102 — Physics Laboratory I	A	3.0
(`Grade Values: A+≡10, A≡9, B+≡8, B≡7, C≡6, D≡5, F≡0`)		S.G.P.A = 7.89

Semester II — Spring 2014

Subject	**Grade**	**Total Credits**
CH1201 — General Physical Chemistry	B	3.0
CH1202 — Physical Chemistry Laboratory	B	3.0
CS1201 — Introduction to Computer Programming	B+	3.0
ES1201 — Earth System Processes	D	3.0
LS1201 — Introduction to Biology II	B	3.0
LS1202 — Biology Laboratory II	A	3.0
MA1201 — Mathematics II	A+	3.0
PH1201 — Physics II	B+	3.0

PH1202 — Physics Laboratory II ..... A 3.0
(`Grade Values: A+≡10, A≡9, B+≡8, B≡7, C≡6, D≡5, F≡0`) S.G.P.A = 7.78

Semester III — Autumn 2014

Subject	**Grade**	**Total Credits**
CH2101 — Inorganic Chemistry I	C	3.0
CH2102 — Quantum Chemistry I	B	2.0
CH2103 — Inorganic and Spectroscopy Laboratory	B+	3.0
MA2101 — Analysis I	B	3.0
MA2102 — Linear Algebra	C	3.0
MA2103 — Foundations I	B+	2.0
PH2101 — Physics III	B+	3.0
PH2102 — Electricity and Electronics	C	2.0
PH2103 — Physics Laboratory III	A	3.0

(`Grade Values: A+≡10, A≡9, B+≡8, B≡7, C≡6, D≡5, F≡0`) S.G.P.A = 7.25

Semester IV — Spring 2015

Subject	**Grade**	**Total Credits**
CH2201 — Fundamentals of Spectroscopy	C	2.0
CH2202 — Reaction Mechanisms in Organic Chemistry	B+	3.0
CH2203 — Synthesis and Characterization Laboratory	A	3.0
MA2201 — Prabability and Statistics	B	3.0
MA2202 — Analysis II	B	3.0
MA2203 — Foundations II	B+	2.0
PH2201 — Physics IV	B	3.0
PH2202 — Thermal Physics	B+	2.0
PH2203 — Physics Laboratory IV	A	3.0

(`Grade Values: A+≡10, A≡9, B+≡8, B≡7, C≡6, D≡5, F≡0`) S.G.P.A = 7.71

Semester V — Autumn 2015

Subject	**Grade**	**Total Credits**
MA3101 — Analysis III	D	3.0
MA3102 — Algebra I	B+	3.0
PH3101 — Intermediate Classical Mechanics	C	3.0
PH3102 — Intermediate Quantum Mechanics	C	3.0
PH3103 — Mathematical Methods of Physics	C	3.0
PH3104 — Electronics Laboratory	B+	3.0
PH3105 — Computational Physics	A	3.0

(`Grade Values: A+≡10, A≡9, B+≡8, B≡7, C≡6, D≡5, F≡0`) S.G.P.A = 6.86

Semester VI — Spring 2016

Subject	**Grade**	**Total Credits**
CH3202 — Physical organic Chemistry	B	3.0
LS3203 — Biophysics II	B	3.0
PH3201 — Basic Statistical Mechanics	B	3.0
PH3202 — Intermediate Electricity and Magnetism	C	3.0
PH3203 — Advanced Quantum Mechanics	D	3.0

PH3204 — Advanced Optics Laboratory ..... A 3.0
PH3205 — Basic Nuclear Physics -
Theory and Laboratory ..... B+ 3.0
(Grade Values: A+≡10, A≡9, B+≡8, B≡7, C≡6, D≡5, F≡0) S.G.P.A = 7.00

Semester VII — Autumn 2016

Subject	**Grade**	**Total Credits**
PH4101 — Basic Condensed Matter Physics	D	3.0
PH4102 — Introductory Astrophysics	C	3.0
PH4103 — Condensed Matter Laboratory	B+	3.0
PH4104 — Nonlinear Dynamics	C	3.0
PH4105 — Advanced Mathematical Methods of physics	B+	3.0
PH4106 — Basics of Field Theory and Relativistic Quantum mechanics	B+	3.0

(Grade Values: A+≡10, A≡9, B+≡8, B≡7, C≡6, D≡5, F≡0) S.G.P.A = 6.83

Semester VIII — Spring 2017

Subject	**Grade**	**Total Credits**
PH4201 — Advanced Experimental Physics	A	3.0
PH4202 — Advanced Statistical Mechanics	B+	3.0
PH4203 — Research Methodology	B	3.0
PH4204 — High Energy Physics	D	3.0
PH4205 — General theory of Relativity and Cosmology	D	3.0
PH4206 — Quantum Many-body Theory	D	3.0

(Grade Values: A+≡10, A≡9, B+≡8, B≡7, C≡6, D≡5, F≡0) S.G.P.A = 6.50

Semester IX — Autumn 2017

Subject	**Grade**	**Total Credits**
PH5101 — BS-MS Project	A	16.0
PH5103 — Biological Physics	D	4.0
PH5110 — Independent Study	A	4.0
Subject	**Grade**	**Total Credits**

(Grade Values: A+≡10, A≡9, B+≡8, B≡7, C≡6, D≡5, F≡0) S.G.P.A = 8.33

Semester X — Spring 2018

Subject	**Grade**	**Total Credits**
PH5201 — BS-MS Project	A	24.0

(Grade Values: A+≡10, A≡9, B+≡8, B≡7, C≡6, D≡5, F≡0) S.G.P.A = 9.00
C.G.P.A = 7.58

ISC 2013

Institute: **Holy Cross School, Agartala**

Subject	**Marks**	**Total marks**
English	86	100
Mathematics	95	100
Physics	88	100

Chemistry	83	100
Computer Science	94	100
SUPW & Community Service	**Internal Assesment Grade:** A	

ICSE 2011

Institute: **Holy Cross School, Agartala**

Subject	**Marks**	**Total marks**
English	92	100
Bengali	86	100
Environmental Education	94	100
History, Civics & Geography (HCS-A, GEO-A)	92	100
Mathematics	92	100
Science (PHY-A, CHE-A, BIO-A)	94	100
Computer Applications	98	100
SUPW & Community Service	**Internal Assesment Grade:** A	

References

1. **Ph.D. thesis supervisor**

   Pranay Goel
   Associate Professor,
   Department of Biology,
   IISER Pune.
   webpage: https://digimed.acads.iiserpune.ac.in/people
   email: pgoel[at]iiserpune.ac.in
   email: pranay.goel[at]gmail.com

2. **BSMS thesis supervisor**

   Soumitro Banerjee
   Professor,
   Department of Physical Sciences,
   IISER Kolkata.
   webpage: https://nld-iiserk-sb.github.io
   email: soumitro[at]iiserkol.ac.in

3. **Collaborator**

   Saroj Ghaskadbi
   Professor,
   Department of Zoology,
   Savitribai Phule Pune University (SPPU), Pune.
   webpage: http://www.unipune.ac.in/dept/science/zoology/zoology_webfiles/zoology-saroj/saroj-ghaskadbi.htm
   email: sghaskadbi[at]gmail.com