Robin Charles Hillyard, Ph.D.

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COMPUTER SCIENTIST, TEACHER, INNOVATOR AND PROBLEM SOLVER

Dedicated teacher of practical software topics for Big Data and general applications. I concentrate on functional programming, algorithms, graphs, with a special interest in machine learning, and reactive programming using Spark and Scala.

Technical Expertise: covers all aspects of software engineering: requirements, planning, architecture, design, languages, object modeling, user interface, agile development, testing, and project management.

Database Expertise: Relational, graph databases, Spark-SQL, object-oriented, NoSQL, and specialized databases.

Range of Applications: Healthcare: information systems and data science, E-commerce, financial services, bank rules, hedge fund. Additionally, online "dating", e-learning, semantic searching and agents, document management, and computer-aided design.

Developments: Object-relational databases, artificial intelligence/machine learning (constraints, rules, inferencing, NLP, neural nets), mathematics (stochastic control, solid modeling, surface modeling, functional libraries, statistics), languages, device drivers, automated testing, reactive programming (Scala, Akka, Play), etc.

Open-source Software: Written and used extensively. Projects include:

- Scala Projects:
  - *Flog*: a functional logger
  - *Comparer*: a functional, composable comparer;
  - *TableParser*: Scala parser of CSV, or other tabular, files;
  - *Number*: a mathematical library involving exact numbers or fuzzy numbers with known precision;
  - *Matchers*: a general library for matching;
  - *Majabigwaduce*: an actor-based map-reduce system.
  - *Calculator*: a Play2-enabled RPN calculator.
  - *Args*: a processor for command-line arguments
  - *KMLdoc*: a reader/writer/processor for keyhole markup language
- Java Projects:
  - *Husky Sort*: the code behind the HuskySort paper.

PROFESSIONAL EXPERIENCE

NORTHEASTERN UNIVERSITY College of Engineering, Boston, MA **Sep 2017—**
Associate Teaching Professor: Multidisciplinary Graduate Engineering, College of Engineering: *Big Data Systems Engineering with Scala; Program Structure and*

Algorithms. **Also, as adjunct professor from Sep 2015-2017.**

- Teaching CSYE 7200 and INFO 6205 and INFO 7374 (Cryptography).

HORTONWORKS/DATAFLOWAGE/PHASMID, Minnesota and Massachusetts
Jan 2016—

Consultant

- Teaching and consulting in Spark (with Scala). Most significant customer: World's largest bank.

OPTUM/CONTATA/PHASMID SOFTWARE, Eden Prairie, MN **Jan 2015—Dec 2015**

Contractor

- At Optum: built innovative machine-learning and graph-database system for closing gaps in care (follow-on from previous position). Hadoop, Spark, GraphX, Zeppelin.

UNITEDHEALTH GROUP (Optum), Waltham, MA **Sep 2010–Sep 2014**
Vice President & Senior Research Fellow

- Review technology trends and build prototypes of components which make up parts of a health-care wide information system.
- Worked with encrypted key-value /relational databases ("cryptobase") and an event-driven substrate in which information may be exchanged under the terms of an "information grant," (patent in process).
- Worked on a big-data artificial intelligence cluster employing Hadoop, particularly in the area of natural language processing.
- Earned finalist spot in company-wide innovation day through work on classification using neural nets. This system used claims/discharge data to predict readmissions.
- Used clustering algorithm to try to spot patterns in insurance claims and appeals.
- Supported, architected and developed an AI/rules project to infer diagnoses from many different types of data.
- Initially worked in Data Science doing NLP on incoming text docs.
- Developed a feature model whereby data can be extracted for such things as lab results (with appropriate units and reference values) for inputting to the feature matrix for doing classification, clustering, etc. with such techniques as neural nets, Bayesian networks, random forests etc.
- Worked on other architectural issues such as the project-wide knowledge repository which is the reference library for such things as LOINC, CPT, NDC, ICD9 codes, etc.
- Architected an appliance which runs *at the source organization* to validate and profile datasets *before* transmitting them to the above-mentioned AI project (or potentially other destinations). Worked with a team of 9 offshore engineers in India.

- Contributed a privacy module which performs anonymization and encryption so that AI/rules engineers would never be presented with real personally identifiable information while developing suspects. Implementation will ensure that no PII is visible data scientists. Only at the time of an attestation by the primary care physician would the true identifying data be recreated.
- Most of the this work has used Java (and PIG), but the information grant work is built on the *Typesafe Reactive Framework* (Scala, Akka, Play).

RUBECULA SOFTWARE LLC: Carlisle, MA 1997 – 2010
Sole Proprietor
Consulting and software development company specializing in aspect-oriented Java solutions for the internet.

- Multiple contracts including 18 months building a hedge fund management system for Fidelity;
- Ongoing open-source contributions included a general interface to mathematical expressions (*jExpression*), package to facilitate the use of the toString() method in Java (*ToString*), a mathematics framework which maintains error bounds and dimensionality of quantities (*JQuantity*);
- a small-footprint bean container with dependency injection (*BeanPot*),
- and a Java framework for evolutionary computation (genetic algorithms): *Darwin*.
- Completed a major overhaul of Darwin believed to be the best and most flexible open-source system for developing new genetic algorithms. Both Darwin and JQuantity exploit techniques which respect the fact that we rarely know anything for certain and measurements are inevitably subject to errors.

NOVASOFT SYSTEMS, Burlington, MA 1987 - 1997
Chief Technology Officer, V.P. Engineering, Co-founder
Technical co-founder of Novasoft Systems, Inc. (renamed as Factpoint and acquired by Cimage), first to provide enterprise client/server systems for Integrated Document Management and Workflow to Fortune 1000 companies, focused on the Pharmaceutical and Computers/ Communications industries.

METAGRAPHICS, Woburn, MA 1983 - 1987
Co-founder, Development Manager
Company was formed expressly to exploit the Variational Geometry technology developed by self at Cambridge University. The application was the interactive generation of accurate CAD/ CAM representations from engineering drawings on paper or microfiche. The product involved the solving and inference of constraint systems and rules.

COMPUTERVISION, Bedford, MA 1982 - 1983
Product Manager for Geometric Modeling including surface modeling and solid modeling. Define product requirement; principal interface between customers/prospects and development staff. Involved in all aspects of marketing the products.

MANUFACTURING DATA SYSTEMS, Ann Arbor, MI 1979 - 1982
Software Engineer
Recruited as one of the leading international pioneers in mathematical modeling of quadric surfaces and their intersections for boundary representations of solid models. This project was years ahead of its time.

EDUCATION

Ph.D., Department of Computer Science ("Computer Lab"), Cambridge University, UK

Dissertation in computer aided design, specifically variational geometry in the discipline of solid modeling: *Dimensions and Tolerances in Shape Design* (1978). This dissertation was ground-breaking work and paved the way for commercially successful solid modeling systems (55 direct citations). Additionally, was awarded the Diploma in Computer Science (1974).

M.A./B.A., Engineering Science, Oxford University, UK

(1st class honors) with specialization in Control Engineering, particularly stochastic digital control.

AWARDS

AIIM: Nelson Award

In recognition of contributions to imaging technology, particularly optical-disk storage and editing capabilities.

PATENTS

- **Waldal; Adam, *Hillyard*; Robin: *Concepts for extracting lab data.* No. 57398763 December 31st 2019 (Filed May 29th, 2015).**

DETAIL

- **Book**: *Data Structures, Algorithms and Invariants*—A Practical Guide, Published 2025 Cognella. ISBN: 978-1-7935-8884-5
- **Technical Papers:**
    - R.C. Hillyard, Yunlu Liaozheng, Sai Vineeth K R, **Huskysort** https://arxiv.org/abs/2012.00866 (rewriting based on reviewer recommendations).
    - R.C. Hillyard and I.C. Braid, **Analysis of dimensions and tolerances in computer-aided mechanical design**, *Computer-Aided Design* (Elsevier), Vol 10-3, pp 161-166 (1978) (242 citations, including four in 2015).
    - R.C. Hillyard and I.C. Braid, **Characterizing non-ideal shapes in terms of dimensions and tolerances,** *ACM SIGGRAPH Computer Graphics*, Vol 12-3, pp 234-238, (1978) (90 citations, including one in 2015).
    - I. C. Braid and R.C. Hillyard, **Geometric modelling in ALGOL 68,** *ACM Sigplan Notices*, Vol 12-6, pp 168-174. (12 citations).
    - IC Braid, RC Hillyard, IA Stroud**, Stepwise construction of polyhedra in geometric modelling.** *Mathematical Methods in Computer Graphics and Design. Ed. KW Brodlie* - 1980 - Academic Press (9 citations)
    - DL Dewhirst and RC Hillyard, **Application of volumetric modeling to mechanical design and analysis**, *Proceedings of the 18th Design Automation Conference* (IEEE press), pp. 171-178 (1981) (four citations).
    - RH Johnson, RC Hillyard, **Application of a computer aided engineering system to manufacturing**, 18th Annual Meeting and Technical Conf. of Numerical Control Society (1981) (three citations).
    - R. Hillyard, **The Build Group of Solid Modelers**, IEEE Computer Graphics, Vol 2-2 pp 43-52 (1982) (72 citations)
- **Languages:** Scala, Java 8, Javascript, SQL, Groovy, C/C++, Perl, Prolog, etc.
- **Technologies:** Hadoop, Spark, GraphX, Zeppelin, OSGi, Spring, Hibernate3, JSP,

Javascript, ColdFusion, JSON, SOAP, XML, JAXP/DOM/SAX/XSL, EJB3, Swing, JMS, JMX, JBoss A/S, Teiid, etc..

- **Tools**: Eclipse, Maven, JUnit, git, Subversion, CVS, Tomcat, HSQLDB, OpenEJB, IIS, Oracle, Ant, Log4J, Rational Rose, TOAD, Windows, Unix, Linux, SQL Sever, Sybase, Jboss Rules.