Northeastern University
College of Computer and Information Science

Repeatability, Reproducibility, Reusability the ACM WiSec Experiment

Guevara Noubir
Northeastern University

History & Motivation

- Reproducibility is an important principle of the scientific method
  - "There is no scientific knowledge of the individual (isolated)" Aristotle
  - Modern scientific method "the foundations of knowledge should be constituted by experimentally produced facts, which can be made believable to a scientific community by their reproducibility" Robert Boyle – src. wikipedia
- Credit motivates solid and far reaching research
  - "standing on the shoulders of giants" from Bernard de Chartres to Isaac Newton
- Healthy research eco-system
- Reduces waste of research resources
- Personal satisfaction
- Unique challenges in the context of Wireless, Mobile, and Security
  - I started advocating for reproducibility at the IEEE CCW 2007 – WiSec 2017

Theory

- Reproducibility is driven by providing a proof
  - Output: papers, theorems supported by proofs

- The proof enables repeatability, and facilitates reproducibility, and reusability

Multiplication Algorithms

- From Brahmagupta to modern computer algorithms

- Trivial way: n^2
- Karatsuba O($n^{\log 3}$) [1962]
- Multiplication using Fast Fourier Transform
  - Strassen-Schonhage O($n \log(n) \operatorname{loglog}(n)$) [1971]
  - Furer $n \log(n)\, 2^{O(\log^* n)}$ [2007]
  - Harvey-van der Hoeven-Lecerf O($n \log(n)\, 2^{2 \log^* n}$) [2014]
  - …

Theoretical Computer Science

- Proofs
- Reductions of hardness (Reusability)
  - Complexity classes: NP-hard, polynomial hierarchy
- Approximation algorithms for optimization
  - Polynomial Time Approximation Algorithms (PTAS): 1+ ϵ within optimum
  - Constant approximation
  - Lower bounds

Examples in Theoretical Computer Science

- Traveling Salesman Problem
- Minimum Steiner Tree
- Matrix Multiplication

Biological Sciences

- A messy science
- Heavily relies on experiments
- Developed protocols for sharing and reporting results

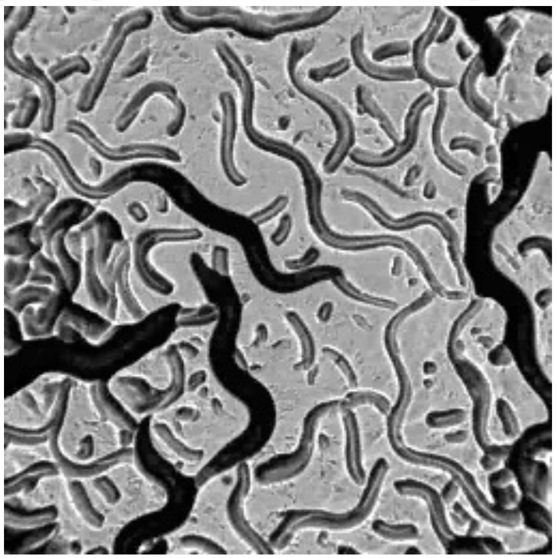
nature nanotechnology

LETTERS

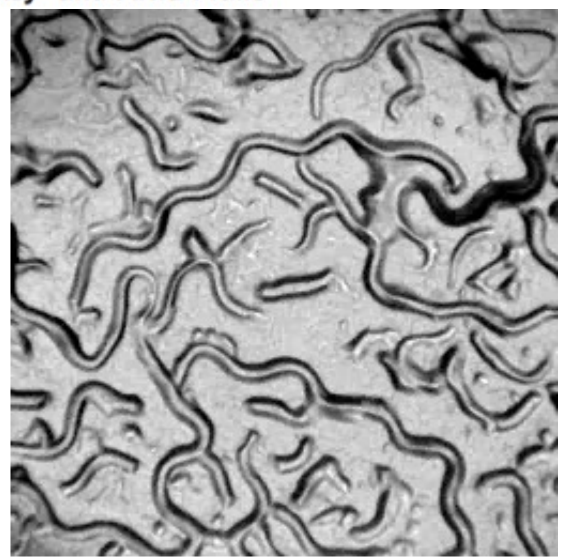
PUBLISHED ONLINE: 27 JUNE 2010 | DOI: 10.1038/NNANO.2010.125

Remote control of ion channels and neurons through magnetic-field heating of nanoparticles

Heng Huang[1], Savas Delikanli[1], Hao Zeng[1], Denise M. Ferkey[2] and Arnd Pralle[1]*



Surface labeled with PEG NPs



Negative control without NPs

- Two-step response of *C. elegans*
  - Halting of forward motion then Retraction

c. elegans freely crawling on e.coli on agarose pad, AC magnetic indicated by gray square , 5fps

Methods

Cell and *C. elegans* culture and imaging. HEK 293 cells, rat hippocampal neurons and *C. elegans* were maintained, transfected and imaged according to standard procedures (for details see Supplementary Information).

Nanoparticle synthesis and functionalization. Manganese ferrite ($MnFe_2O_4$) nanoparticles (6 nm) were synthesized according to published procedures[12]. See Supplementary Information and references[12,13] for details of synthesis. They were made water-dispersible by surface ligand exchange and coated with 2,3-dimercaptosuccinic acid (DMSA) following modified procedures by Jun and Lee[14]. $MnFe_2O_4$ nanoparticle dispersion (200 µl) in hexane was washed with methanol to remove excess surfactant oleylamine. The precipitants were redissolved in hexane and added dropwise into a DMSA solution (9 mg ml^{-1}) in methanol. The precipitated nanoparticles were washed with acetone, dried, and dissolved in 200 µl of 2.5% NH_4OH solution. The pH value of the nanoparticle aqueous solution was adjusted to 8.0 by flowing nitrogen gas above the solution to accelerate reduction of NH_4^+ to NH_3.

For further stabilization, and to provide a means for specific targeting, the nanoparticles were conjugated with streptavidin[15]. The nanoparticles were conjugated with streptavidin–DyLight-549 (Pierce) using succinimidyl-4-[*N*-maleimidomethyl]-cyclohexane-1-carboxylate (SMCC, Pierce) as cross-linker. The final hydrodynamic radius of the nanoparticles was expected to be 6 to 8 nm.

Nanoparticle targeting to cell membrane and amphid of *C. elegans*. The cells of interest were genetically labelled by expressing the engineered membrane marker protein AP-CFP-TM, which contains a transmembrane domain (TM) of the platelet-derived growth factor, an extracellular cyan fluorescent protein (CFP) and a biotin acceptor peptide (AP)[19,20]. The biotin acceptor peptide was enzymatically biotinylated by the co-expressed BirA protein, forming specific binding sites for the streptavidin-conjugated nanoparticles.

For experiments with *C. elegans*, the nanoparticles were PEG-phospholipid coated following procedures similar to those of Grancharov and colleagues[26], in which 60 µl of $MnFe_2O_4$ nanoparticle solution in hexane was washed with methanol to remove the surfactant oleylamine. The precipitants were dissolved in 650 µl of chloroform, and 60 µl of DSPE-methoxy PEG (2000) (10 mg ml^{-1}), 60 µl of maleimide-PEG (2000) (10 mg ml^{-1}) and 30 µl of DSPE-PEG (2000)-carboxy fluorescein (0.5 mg ml^{-1}) (all from Avanti Polar Lipids) were then added to the chloroform solution and mixed for 1 h in the dark. After evaporating the chloroform, the phospholipid-coated nanoparticles were dissolved in 600 µl of distilled water and incubated at 80 °C for 12 h before removing excess PEG-phospholipids.

RF magnetic-field and bulk solution heating. A 40 MHz sinusoidal signal was provided by a signal generator (Marconi Instruments), amplified by a 100 W amplifier (Amplifier Research), and applied to a 25-turn solenoid coil with a diameter of 7 mm. The magnetic field strength was adjusted between 0.67 and 1 kA m^{-1} (8.4 to 13 G). The coil was insulated with a 500-µm coating and positioned directly above the sample using a micromanipulator.

When subjected to a RF magnetic field (40 MHz, 8.4 G), the temperature in an aqueous dispersion of the DMSA-coated nanoparticles (20 mg ml^{-1}) increased at an initial rate of 0.62 °C s^{-1}, as measured with a thermocouple. This heating corresponds to a specific absorption rate (SAR) of 2.51 J g^{-1} s^{-1} (Supplementary Fig. S1).

Local heat quantification. Local temperature changes were measured by recording the changes in fluorescence intensity of fluorophores (DyLight549, YFP or ANNINE6), subtracting the bleach rate, and converting it into a temperature change based on the measured temperature dependence of the fluorescence intensity. The $\Delta F(T)/F(T_0)$ of these fluorophores are −1.5% for DyLight549, −1.3% for YFP, −0.81% for ANNINE6 and −1.2% for fluorescein (Supplementary Fig. S3).

Received 7 March 2010; accepted 19 May 2010; published online 27 June 2010

Supplementary

- 10 pages making every step explicit

nature nanotechnology | SUPPLEMENTARY INFORMATION
DOI: 10.1038/NNANO.2010.125

"Remote control of ion-channels and neurons through magnetic field heating of nanoparticles"

Heng Huang, Savas Delikanli, Hao Zeng, Denise M. Ferkey, Arnd Pralle

SUPPLEMENTARY INFORMATION

Supplementary Methods

Nanoparticle Synthesis and Functionalization

A mixture of 2 mM of $Fe(acac)_3$, 1 mM of $Mn(acac)_2$, 10 mM of 1,2-hexadecandiol, 6 mM of oleic acid, 6 mM of oleylamine and 25 ml of benzyl ether was heated and maintained at 110˚ C for 1 hr under N_2 flow. The temperature was then raised to 210˚ C for 2 hrs. Under N_2 blanketing, the mixture was heated to a reflux temperature of about 295˚ C, and kept refluxing for 1 hr. The solution mixture was cooled to room temperature, and the nanoparticles were precipitated by adding ethanol, before being dissolved in hexane (More details in [1,2]).

Cell Culture

Human embryonic kidney (HEK 293) cells were cultured in Dulbecco's modified Eagle's medium (DMEM) supplemented with 10% fetal bovine serum and 1% penicillin-streptomycin (Invitrogen) at 37˚C under 5% CO_2. For imaging, the cells were plated sparsely on 35-mm glass coverslips. Transfections were performed 24 h after plating using Lipofectamine 2000 (Invitrogen). For calcium imaging, cells were co-transfected with equal amount of plasmids encoding TRPV1 (in pcDNA vector), TN-XL (pcDNA) [23] and AP-CFP-TM (pDISPLAY)[3] (0.4 µg each). 24 h after transfection, a mixture of BirA enzyme (2 µM) and biotin (5 µM) was added to the cell culture media[4,5]. After incubation at 37˚C for 30 min, the cells were washed 3 times with Phosphate Buffered Saline (PBS) solution and incubated with Streptavidin-DyLight

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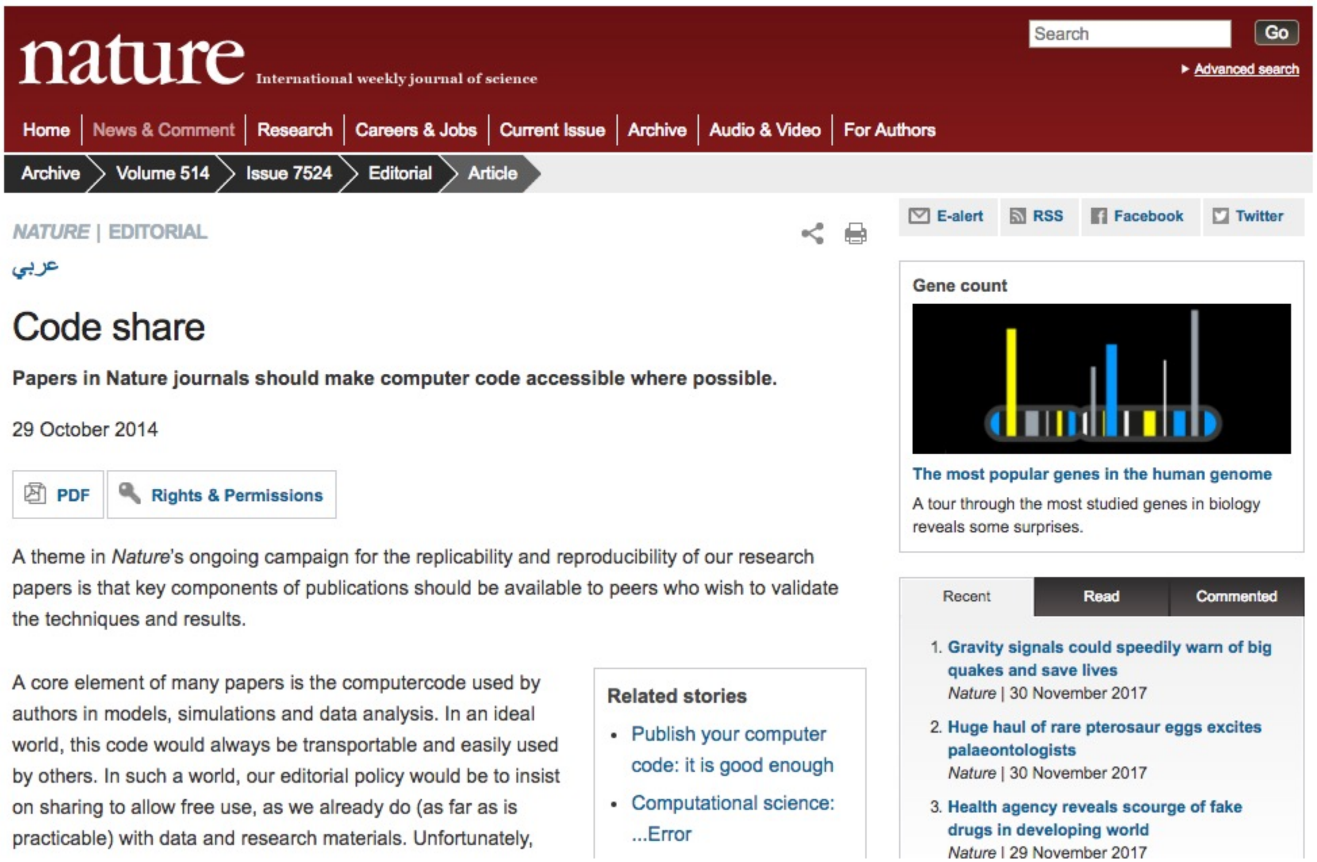
[1] Zeng, H., Rice, P. M., Wang, S. X. & Sun, S. Shape-controlled synthesis and shape-induced texture of MnFe2O4 nanoparticles. *J Am Chem Soc* 126, 11458-11459 (2004).
[2] Sun, S. *et al.* Monodisperse MFe2O4 (M = Fe, Co, Mn) nanoparticles. *J Am Chem Soc* 126, 273-279 (2004).
[3] Howarth, M. *et al.* A monovalent streptavidin with a single femtomolar biotin binding site. *Nat Methods* 3, 267-273 (2006)
[4] Howarth, M., Takao, K., Hayashi, Y. & Ting, A. Y. Targeting quantum dots to surface proteins in living cells with biotin ligase. *Proc Natl Acad Sci U S A* 102, 7583-7588 (2005).
[5] Howarth, M. & Ting, A. Y. Imaging proteins in live mammalian cells with biotin ligase and monovalent streptavidin. *Nat Protoc* 3, 534-545 (2008).

Nature Journal on Code Availability



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Archive > Volume 514 > Issue 7524 > Editorial > Article

NATURE | EDITORIAL

عربي

Code share

Papers in Nature journals should make computer code accessible where possible.

29 October 2014

PDF | Rights & Permissions

A theme in *Nature*'s ongoing campaign for the replicability and reproducibility of our research papers is that key components of publications should be available to peers who wish to validate the techniques and results.

A core element of many papers is the computercode used by authors in models, simulations and data analysis. In an ideal world, this code would always be transportable and easily used by others. In such a world, our editorial policy would be to insist on sharing to allow free use, as we already do (as far as is practicable) with data and research materials. Unfortunately,

Related stories

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- Computational science: ...Error

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Gene count

The most popular genes in the human genome

A tour through the most studied genes in biology reveals some surprises.

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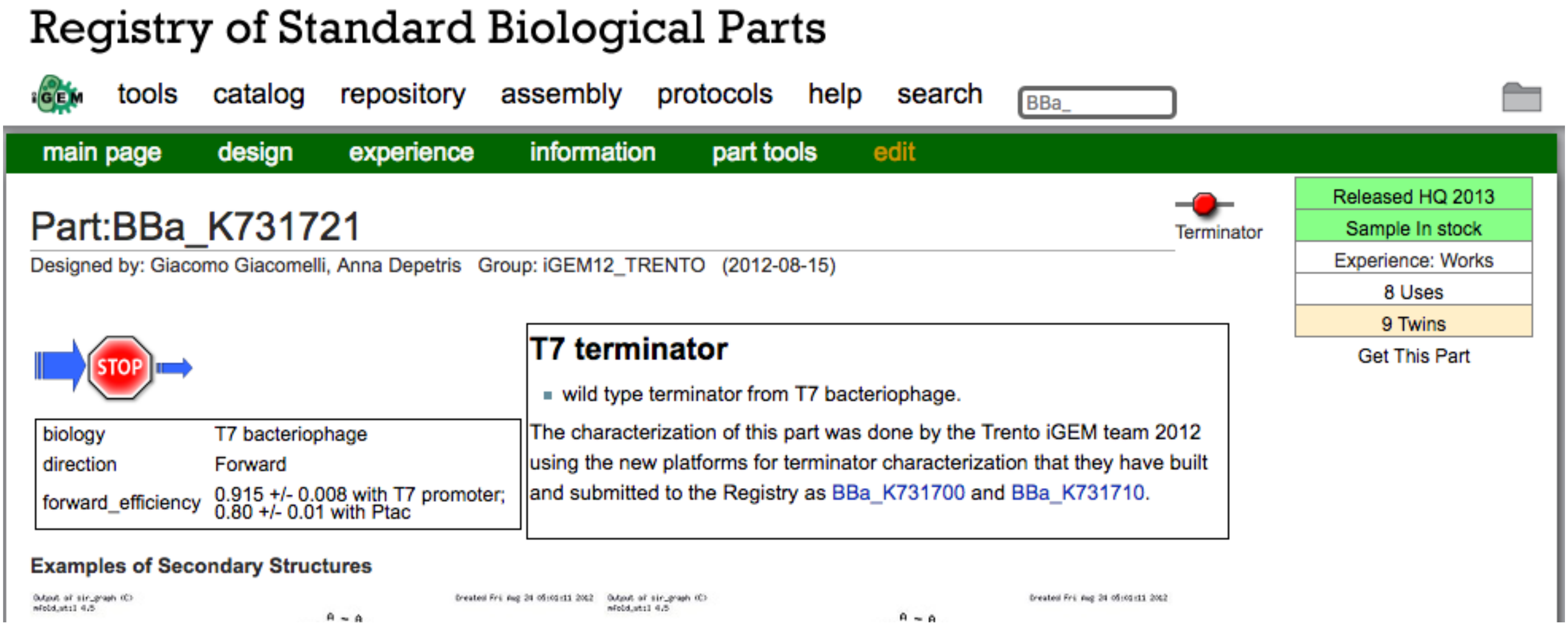
   Nature | 29 November 2017

Synthetic Biology: BioBricks Registery


Registry of Standard Biological Parts

tools catalog repository assembly protocols help search BBa_

main page design experience information part tools edit

Part:BBa_K731721

Designed by: Giacomo Giacomelli, Anna Depetris Group: iGEM12_TRENTO (2012-08-15)

Terminator

Released HQ 2013
Sample In stock
Experience: Works
8 Uses
9 Twins
Get This Part

biology	T7 bacteriophage
direction	Forward
forward_efficiency	0.915 +/- 0.008 with T7 promoter; 0.80 +/- 0.01 with Ptac

T7 terminator

- wild type terminator from T7 bacteriophage.

The characterization of this part was done by the Trento iGEM team 2012 using the new platforms for terminator characterization that they have built and submitted to the Registry as BBa_K731700 and BBa_K731710.

Examples of Secondary Structures

Reproducibility in Applied CS

- Databases
- Computer Vision
- Artifacts Evaluations

ACM SIGMOD 2016 Reproducibility

What is SIGMOD Reproducibility?

SIGMOD Reproducibility has three goals:

- Highlight the impact of database research papers.
- Enable easy dissemination of research results.
- Enable easy sharing of code and experimentation set-ups.

Reproducible Label

The experimental results of the paper were reproduced by the committee and were found to support the central results reported in the paper. The experiments (data,code,scripts) are made available to the community.

> The "Reproducible label" will be visible in the **ACM digital library**.

- Process takes 1.5 months

ACM SIGMOD 2016 Reproducibility

Readme for reproducibility submission of paper

A) Source code info

- Repository: [url]
- Programming Language: [C/C++/java/...]
- Additional Programming Language info: [optional, e.g., java version]
- Compiler Info: [full details of compiler and version]
- Packages/Libraries Needed: [an as thorough as possible list of software packages needed]

B) Datasets info

- Repository: [url]
- Data generators: [url]

C) Hardware Info[Here you should include any details and comments about the used hardware in order to be able to accommodate the reproducibility effort. Any information about non-standard hardware should also be included. You should also include at least the following info:]

- C1) Processor (architecture, type, and number of processors/sockets)
- C2) Caches (number of levels, and size of each level)
- C3) Memory (size and speed)
- C4) Secondary Storage (type: SSD/HDD/other, size, performance: random read/sequnetial read/random write/sequnetial write)
- C5) Network (if applicable: type and bandwidth)

D) Experimentation Info

- D1) Scripts and how-tos to generate all necessary data or locate datasets[Ideally, there is a script called: ./prepareData.sh]
- D2) Scripts and how-tos to prepare the software for system[Ideally, there is a script called: ./prepareSoftware.sh]
- D3) Scripts and how-tos for all experiments executed for the paper[Ideally, there is a script called: ./runExperiments.sh]

Computer Vision: Face Detection

Face detection without bells and whistles

ECCV'2014

Markus Mathias [1] Rodrigo Benenson [2] Marco Pedersoli [1] Luc Van Gool [1,3]

- "Due to the lack of a commonly accepted annotation guidelines and evaluation protocols, a fair evaluation of face detectors on various data sets is still missing"

– We point out that the evaluation of existing face datasets is biased due to different guidelines for the annotation. We provide improved annotations and a new evaluation criteria that copes better with these problems (section 2).
– We show that (despite common belief) face detection has not saturated, and there are still relevant open questions to explore (section 6).

Artifacts Evaluation

- ACM terminology inspired by (Metrology)
  - Repeatability (Same team, same experimental setup)
  - Replicability (Different team, same experimental setup)
  - Reproducibility (Different team, different experimental setup)
- Artifacts Evaluation Committee
  - Still optional for accepted papers
  - Few weeks
- Several conferences
  - CAV, PLDI

Challenges in Mobile and Wireless

- Much harder problem

- The propagation channel is difficult to control and reproduce
  - Surrounding objects, their mobility, temperature, rain, wind, other communications

Some of the Approaches

- Theory approach
  - Assume a model and prove properties
  - UDG, AWGN, or random gains matrix
  - Do not provide much insight into real world performance
  - Models should derive from experimental measurements
- Simulations
  - Physical layer
  - All stack discrete event simulator
  - Limitations: scale and accuracy
- Emulation
- Live experimental measurements

Simulations

- Communications/standardisation community had procedures for evaluating performance

- Recommendation ITU-R M.1225 [1997]
  - Guidelines for evaluation of radio transmission technologies for imt-2000
  - 60 pages document

RECOMMENDATION ITU-R M.1225

GUIDELINES FOR EVALUATION OF RADIO TRANSMISSION TECHNOLOGIES FOR IMT-2000

(Question ITU-R 39/8)

(1997)

CONTENTS

1 Introduction

International Mobile Telecommunications-2000 (IMT-2000) are third generation mobile systems which are scheduled to start service around the year 2000 subject to market considerations. They will provide access, by means of one or more radio links, to a wide range of telecommunication services supported by the fixed telecommunication networks (e.g. PSTN/ISDN), and to other services which are specific to mobile users.

A range of mobile terminal types is encompassed, linking to terrestrial and/or satellite based networks, and the terminals may be designed for mobile or fixed use.

Key features of IMT-2000 are:

– high degree of commonality of design worldwide,

– compatibility of services within IMT-2000 and with the fixed networks,

– high quality,

– use of a small pocket terminal with worldwide roaming capability.

IMT-2000 will operate worldwide in bands identified by Radio Regulations provision No. S5.388 (1 885-2 025 and 2 110-2 200 MHz, with the satellite component limited to 1 980-2 010 and 2 170-2 200 MHz). IMT-2000 are defined by a set of interdependent ITU Recommendations, of which this Recommendation is a member.

It is a design objective of IMT-2000 that the number of radio interfaces should be minimal and, if more than one interface is required, that there should be a high degree of commonality between them. These radio interfaces will serve the radio operating environments as nominated in Recommendation ITU-R M.1034. A number of sets of radio transmission technologies (SRTTs) may meet the requirements for the radio interfaces. This Recommendation contains the procedure and criteria that will be used to evaluate candidate radio transmission technologies (RTTs).

The subject matter of IMT-2000 is complex and its representation in the form of Recommendations is evolving. To maintain the pace of progress on the subject it is necessary to produce a sequence of Recommendations on a variety of aspects. The recommendations strive to avoid apparent conflicts between themselves. Nevertheless, future Recommendations, or revisions, will be used to resolve any discrepancies.

2 Scope

This Recommendation provides guidelines for both the procedure and the criteria to be used in evaluating RTTs for a number of test environments. These test environments, defined herein, are chosen to simulate closely the more stringent radio operating environments. The evaluation procedure is designed in such a way that the impact of the candidate RTTs on the overall performance and economics of IMT-2000 may be fairly and equally assessed on a technical basis. It ensures that the overall IMT-2000 objectives are met.

The Recommendation provides, for proponents and developers of RTTs, the common bases for the submission and evaluation of RTTs and system aspects impacting the radio performance.

ITU-R M.1225 [1997]

- **7 Selected test environments for evaluation**

  The test environments for evaluation are discussed in Annex 2. The selected test operating environments are the following:

  – indoor office,

  – outdoor to indoor and pedestrian,

  – vehicular,

  – mixed-cell pedestrian/vehicular,

  – satellite.

  The key parameters to describe each propagation model would include:

  – time delay-spread, its structure, and its statistical variability (e.g. probability distribution of time delay spread);

  – geometrical path loss rule (e.g. R^{-4}) and excess path loss;

  – shadow fading;

  – multipath fading characteristics (e.g. Doppler spectrum, Rician vs. Rayleigh) for the envelope of channels;

  – operating radio frequency.

1.2.1.1 Path loss model for indoor office test environment

The indoor path loss model (dB) is in the following simplified form, which is derived from the COST 231 indoor model presented in Appendix 1. This low increase of path loss versus distance is a worst-case from the interference point of view:

$$L = 37 + 30 \log_{10} R + 18.3\, n^{\left(\frac{n+2}{n+1} - 0.46\right)}$$

where:

R: transmitter-receiver separation (m)

n: number of floors in the path.

NOTE 1 – L shall in no circumstances be less than free space loss. A log-normal shadow fading standard deviation of 12 dB can be expected.

1.2.1.2 Path loss model for outdoor to indoor and pedestrian test environment

The following model should be used for the outdoor to indoor and pedestrian test environment:

$$L = 40 \log_{10} R + 30 \log_{10} f + 49$$

where:

R: base station – mobile station separation (km)

f: carrier frequency of 2 000 MHz for IMT-2000 band application.

NOTE 1– L shall in no circumstances be less than free space loss. This model is valid for non-line-of-sight (NLOS) case only and describes worse case propagation. Log-normal shadow fading with a standard deviation of 10 dB for outdoor users and 12 dB for indoor users is assumed. The average building penetration loss is 12 dB with a standard deviation of 8 dB.

1.2.1.3 Path loss model for vehicular test environment

This model, based on the same general format as in § 1.2.1.2, is applicable for the test scenarios in urban and suburban areas outside the high rise core where the buildings are of nearly uniform height:

$$L = 40 (1 - 4 \times 10^{-3}\, \Delta h_b) \log_{10} R - 18 \log_{10} \Delta h_b + 21 \log_{10} f + 80 \qquad \text{dB}$$

where:

R: base station – mobile station separation (km)

f: carrier frequency of 2 000 MHz

Δh_b: base station antenna height (m), measured from the average rooftop level.

To quantitatively evaluate each RTT, the base station antenna height is fixed at 15 m above the average rooftop ($\Delta h_b = 15$ m). Each proponent has an option to specify an alternate base station antenna height to optimize coverage and spectrum efficiency in their proposal.

NOTE 1 – L shall in no circumstances be less than free space loss. This model is valid for NLOS case only and describes worse case propagation. Log-normal shadow fading with 10 dB standard deviation are assumed in both urban and suburban areas.

NOTE 2 – The path loss model is valid for a range of Δh_b from 0 to 50 m.

1.2.1.4 Decorrelation length of the long-term fading

The long-term (log-normal) fading in the logarithmic scale around the mean path loss L (dB) is characterized by a Gaussian distribution with zero mean and standard deviation. Due to the slow fading process versus distance Δx, adjacent fading values are correlated. Its normalized autocorrelation function $R(\Delta x)$ can be described with sufficient accuracy by an exponential function (Gudmundson, M. [7 November, 1991] Correlation Model for Shadow Fading in Mobile Radio Systems. *Electron. Lett.*, Vol. 27, **23**, 2145-2146):

$$R(\Delta x) = e^{-\frac{|\Delta x|}{d_{cor}} \ln 2}$$

with the decorrelation length d_{cor}, which is dependent on the environment. This concept can be applied in the vehicular test environment with a decorrelation length of 20 m.

1.2.2 Channel impulse response model

For each terrestrial test environment, a channel impulse response model based on a tapped-delay line model is given. The model is characterized by the number of taps, the time delay relative to the first tap, the average power relative to the strongest tap, and the Doppler spectrum of each tap. A majority of the time, r.m.s. delay spreads are relatively small, but occasionally, there are "worst case" multipath characteristics that lead to much larger r.m.s. delay spreads. Measurements in outdoor environments show that r.m.s. delay spread can vary over an order of magnitude, within the same environment. Although large delay spreads occur relatively infrequently, they can have a major impact on system performance. To accurately evaluate the relative performance of candidate RTTs, it is desirable to model the variability of delay spread as well as the "worst case" locations where delay spread is relatively large.

As this delay spread variability cannot be captured using a single tapped delay line, up to two multipath channels are defined for each test environment. Within one test environment channel A is the low delay spread case that occurs frequently, channel B is the median delay spread case that also occurs frequently. Each of these two channels is expected to be encountered for some percentage of time in a given test environment. Table 2 gives percentage of time the particular channel may be encountered with the associated r.m.s. average delay spread for channel A and channel B for each terrestrial test environment.

TABLE 2

Parameters for channel impulse response model

Test environment	Channel A		Channel B	
	r.m.s. (ns)	P (%)	r.m.s. (ns)	P (%)
Indoor office	35	50	100	45
Outdoor to indoor and pedestrian	45	40	750	55
Vehicular – high antenna	370	40	4 000	55

Tables 3 to 5 describe the tapped-delay-line parameters for each of the terrestrial test environments. For each tap of the channels three parameters are given: the time delay relative to the first tap, the average power relative to the strongest tap, and the Doppler spectrum of each tap. A small variation, ±3%, in the relative time delay is allowed so that the channel sampling rate can be made to match some multiple of the link simulation sample rate.

Simulations in Wireless Networking

- Networking community
  - Expertise in simulating data networks (discrete event simulator)
- Issues with simulators for wireless networks
  - Accuracy of physical/link layer models
- Results cannot be always reproduced across simulators
  - Even for a simple flooding protocol
  - Opnet, Glomosim, NS-2 [Cavin, Sasson, Schiper 2002]

10th Annual ACM WiSec Conference

SECURITY AND PRIVACY IN WIRELESS AND MOBILE NETWORKS

Northeastern University
College of Computer and Information Science

JULY 18TH – 20TH,
Interdisciplinary Science and Engineering Complex (ISEC)

http://wisec2017.ccs.neu.edu

WiSec 2017 Experiment

- Prepare a VirtualBox VM with all data/tools installed
  - Raw data (without any pre-processing)
  - Scripts used for pre-processing
- For each graph/table, provide a directory (Fig_XXX, Table_XXX)
  - Contains a script that enables the committee to regenerate that object
- In home directory a readme file, according to the following format.
  - The authors can use the following script to generate information about the configuration of the machine that was used for the experiments.
- Provide a link to downloading the VM (e.g., google drive or dropbox), or request credentials to upload the VM to the conference storage system.

Readme for reproducibility submission of paper ID [paperID]

A) Source code info
Repository: [url]
List of Programming Languages: [C/C++/java/Python...]
Compiler Info: [full details of compiler and version]
Packages/Libraries Needed: [an as thorough as possible list of software packages needed]

- B) Datasets info
Repository: [url]
Data generators: [url]

C) Hardware Info
[Here you should include any details and comments about the used hardware in order to be able to accommodate the reproducibility effort. Any information about non-standard hardware should also be included. You should also include at least the following info:]
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C2) Caches (number of levels, and size of each level)
C3) Memory (size and speed)
C4) Secondary Storage (type: SSD/HDD/other, size, performance: random read/sequential read/random write/sequential write)
C5) Network (if applicable: type and bandwidth)
C6) GPU
C7) SDR

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ACM WiSec 2017 Papers

- **Massive Reactive Smartphone-Based Jamming using Arbitrary Waveforms and Adaptive Power Control** Paper VM
  Matthias Schulz (Technische Universität Darmstadt, Germany), Francesco Gringoli (University of Brescia, Italy), Daniel Steinmetzer (Technische Universität Darmstadt, Germany), Michael Koch (Technische Universität Darmstadt, Germany), Matthias Hollick (Technische Universität Darmstadt, Germany)
- **Binary Hash Tree based Certificate Access Management for Connected Vehicles** Paper VM
  Virendra Kumar (OnBoard Security), Jonathan Petit (OnBoard Security), William Whyte (OnBoard Security)
- **Opinion: PHY-Layer Security is no Alternative to Cryptography** Paper VM
  Pieter Robyns (UHasselt - tUL - imec), Peter Quax (UHasselt - tUL - imec), Wim Lamotte (UHasselt - tUL - imec)
- **An Autonomic and Permissionless Android Covert Channel** Paper VM
  Ken Block (Northeastern University), Sashank Narain (Northeastern University), Guevara Noubir (Northeastern University)
- **Trashing IMSI Catchers in Mobile Networks** Paper VM
  Mohammed Shafiul Alam Khan (ISG, Royal Holloway, University of London), Chris J Mitchell (ISG, Royal Holloway, University of London)
- **Resilient Privacy Protection for Location-Based Services Through Decentralization** Paper VM
  Hongyu Jin (KTH), Panos Papadimitratos (KTH)

Open Questions

- How to deal licenses

- Private code / IP
- Private datasets

- How to validate the data on which the algorithm is running?
  - Hard question for wireless
  - Others can create new datasets and test on it
  - Requires clear description on how data was collected
  - Clear separation between code and data

- Next steps for reproducibility, and reusability
  - Include a public rating/reviewing system on the hosting server

Thanks to

- ACM SIGSAC

- Reproducibility Committee of ACM WiSec 2017