MIMIC-III:
A free publicly available EHR Database for Research

Earl F Glynn

Data Scientist
Research Informatics

KU Med
Frontier's Informatics Meetup
2019-09-26

https://github.com/EarlGlynn/MIMIC-III-Exploration

Outline

- What is MIMIC-III?
- MIMIC-III: Research and Education
- Getting Started with MIMIC-III
- MIMIC-III Explorations
- Machine Learning Using MIMIC-III
- Other PhysioNet Resources
- Take Home

What is MIMIC-III?

https://physionet.org/content/mimiciii/1.4/

https://mimic.physionet.org/
https://github.com/MIT-LCP/mimic-code

PhysioNet is a repository of freely-available medical research data, managed by the MIT Laboratory for Computational Physiology

Collaborative research

MIMIC is an openly available dataset developed by the MIT Lab for Computational Physiology, comprising deidentified health data associated with ~60,000 intensive care unit admissions. It includes demographics, vital signs, laboratory tests, medications, and more.

MIMIC = Medical Information Mart for Intensive Care

Children's Mercy

What is MIMIC-III?

- https://www.nature.com/articles/sdata201635

SCIENTIFIC DATA

Data Descriptor | Open Access | Published: 24 May 2016

MIMIC-III, a freely accessible critical care database

Alistair E.W. Johnson, Tom J. Pollard, Lu Shen, Li-wei H. Lehman, Mengling Feng, Mohammad Ghassemi, Benjamin Moody, Peter Szolovits, Leo Anthony Celi & Roger G. Mark

Scientific Data **3**, Article number: 160035 (2016) | Download Citation

"MIMIC-III integrates deidentified, comprehensive clinical data of patients admitted to the Beth Israel Deaconess Medical Center in Boston, Massachusetts, and makes it widely accessible to researchers Internationally under a data use agreement."

Children's Mercy

MIMIC-III: Research and Education

- MIMIC-III supports applications including academic and industrial research, quality improvement initiatives, and higher education coursework.
- MIMIC-III is great data source for data science experiments, including predictive analytics.

Getting Started with MIMIC-III

- Training Requirements
- Online Resources
- Loading Postgres Database
- Querying MIMIC-III

https://github.com/EarlGlynn/MIMIC-III-Getting-Started

Getting Started with MIMIC-III

Training Requirements

- https://mimic.physionet.org/gettingstarted/access/

Complete the required training course

Prior to requesting access to MIMIC, you will need to complete the CITI "Data or Specimens Only Research" course:

- First register on the CITI program website, selecting "Massachusetts Institute of Technology Affiliates" as your organization affiliation (***not*** *"independent learner"*): https://www.citiprogram.org/index.cfm?pageID=154&icat=0&ac=0
- Follow the links to add a Massachusetts Institute of Technology Affiliates course. In the Human Subjects training category, select the "Data or Specimens Only Research" course
- Complete the course and save a copy of your completion report. The completion report lists all modules completed, with dates and scores.

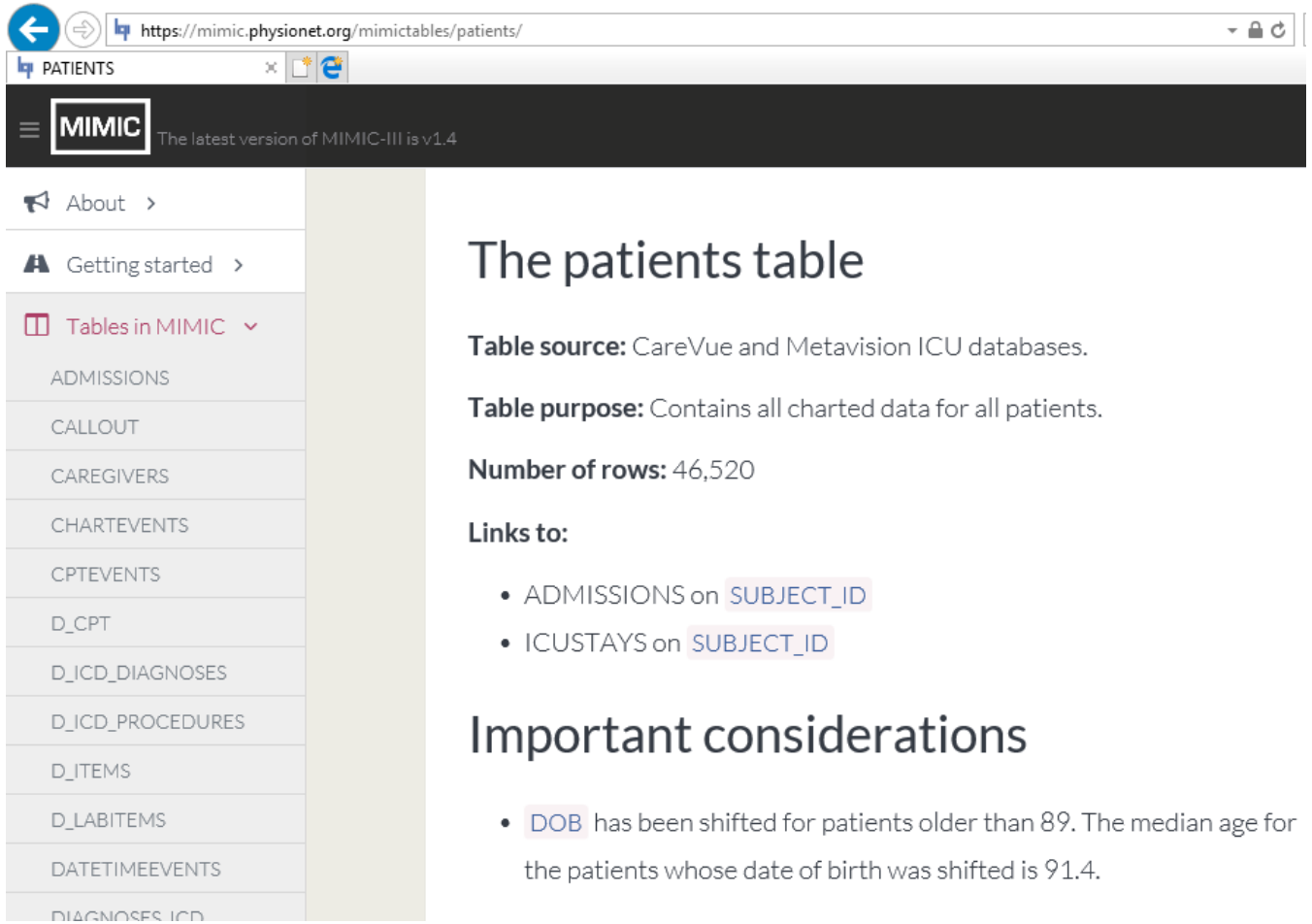
COLLABORATIVE INSTITUTIONAL TRAINING INITIATIVE (CITI PROGRAM)

REQUIRED AND ELECTIVE MODULES ONLY

History and Ethics of Human Subjects Research (ID: 498)
Basic Institutional Review Board (IRB) Regulations and Review Process (ID: 2)
Records-Based Research (ID: 5)
Genetic Research in Human Populations (ID: 6)
Populations in Research Requiring Additional Considerations and/or Protections (ID: 16680)
Research and HIPAA Privacy Protections (ID: 14)
Conflicts of Interest in Human Subjects Research (ID: 17464)
Massachusetts Institute of Technology (ID: 1290)

Getting Started with MIMIC-III

Online Resource: Data Dictionary

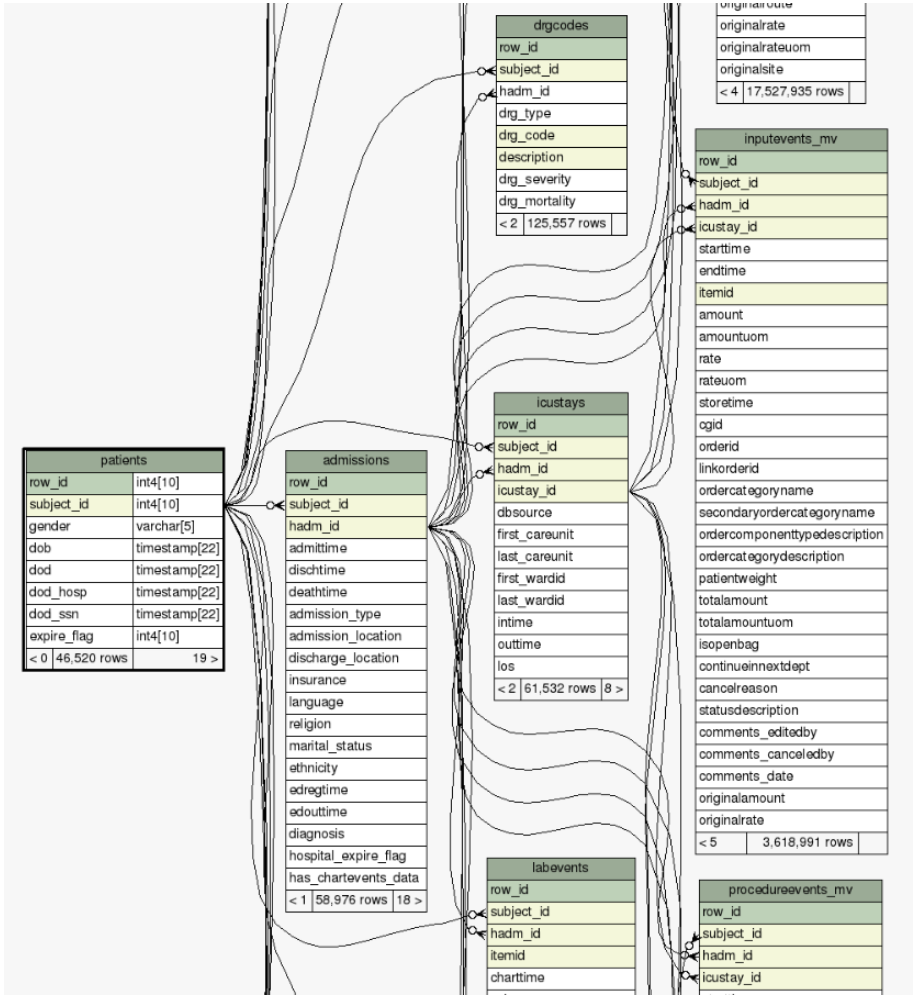


Date-of-Birth ranges from 1800 to 2201!

https://mimic.physionet.org/mimictables/patients/

Children's Mercy

Online Resource: Database Schema



https://mit-lcp.github.io/mimic-schema-spy/tables/patients.html

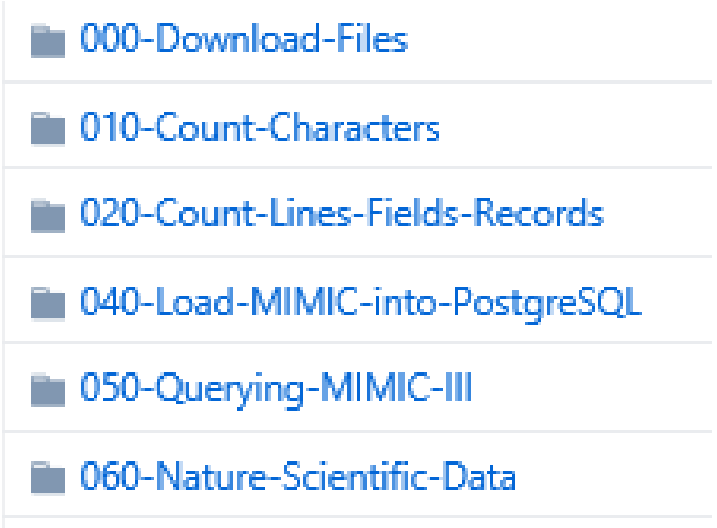
Children's Mercy

Getting Started with MIMIC-III

Loading Postgres Database

https://mimic.physionet.org/gettingstarted/dbsetup/

https://github.com/EarlGlynn/MIMIC-III-Getting-Started



Quality Checks
count.fields
Loading databse
SQL / R dplyr examples
Jupyter notebook example

Children's Mercy

Loading Postgres Database

Filename	Lines	Records	Fields
ADMISSIONS.csv	58,977	58,977	19
CALLOUT.csv	34,500	34,500	24
CAREGIVERS.csv	7,568	7,568	4
CHARTEVENTS.csv	330,712,484	330,712,484	15
CPTEVENTS.csv	573,147	573,147	12
D_CPT.csv	135	135	9
D_ICD_DIAGNOSES.csv	14,568	14,568	4
D_ICD_PROCEDURES.csv	3,883	3,883	4
D_ITEMS.csv	12,488	12,488	10
D_LABITEMS.csv	754	754	6
DATETIMEEVENTS.csv	4,485,938	4,485,938	14
DIAGNOSES_ICD.csv	651,048	651,048	5
DRGCODES.csv	125,558	125,558	8

Filename	Lines	Records	Fields
ICUSTAYS.csv	61,533	61,533	12
INPUTEVENTS_CV.csv	17,527,936	17,527,936	22
INPUTEVENTS_MV.csv	3,618,992	3,618,992	31
LABEVENTS.csv	27,854,056	27,854,056	9
MICROBIOLOGYEVENTS.csv	631,727	631,727	16
NOTEEVENTS.csv	91,692,309	2,083,181	11
OUTPUTEVENTS.csv	4,349,219	4,349,219	13
PATIENTS.csv	46,521	46,521	8
PRESCRIPTIONS.csv	4,156,451	4,156,451	19
PROCEDUREEVENTS_MV.csv	258,067	258,067	25
PROCEDURES_ICD.csv	240,096	240,096	5
SERVICES.csv	73,344	73,344	6
TRANSFERS.csv	261,898	261,898	13

020-Count-Lines-Fields-Records\MIMIC-III-Will-Files-Parse.nb.html

All counts include header records

Loading Postgres Database

Use Natural Language Processing with NOTEEVENTS

…
HISTORY OF PRESENT ILLNESS: This is an 81-year-old female with a history of emphysema (not on home O2), who presents with three days of shortness of breath thought by her primary care doctor to be a COPD flare. Two days prior to admission, she was started on a prednisone taper and one day prior to admission she required oxygen at home in order to maintain oxygen saturation greater than 90%. She has also been on levofloxacin and nebulizers, and was not getting better, and presented to the [**Hospital1 18**] Emergency Room.

In the [**Hospital3 **] Emergency Room, her oxygen saturation was 100% on CPAP. She was not able to be weaned off of this despite nebulizer treatment and Solu-Medrol 125 mg IV x2.
…

Getting Started with MIMIC-III

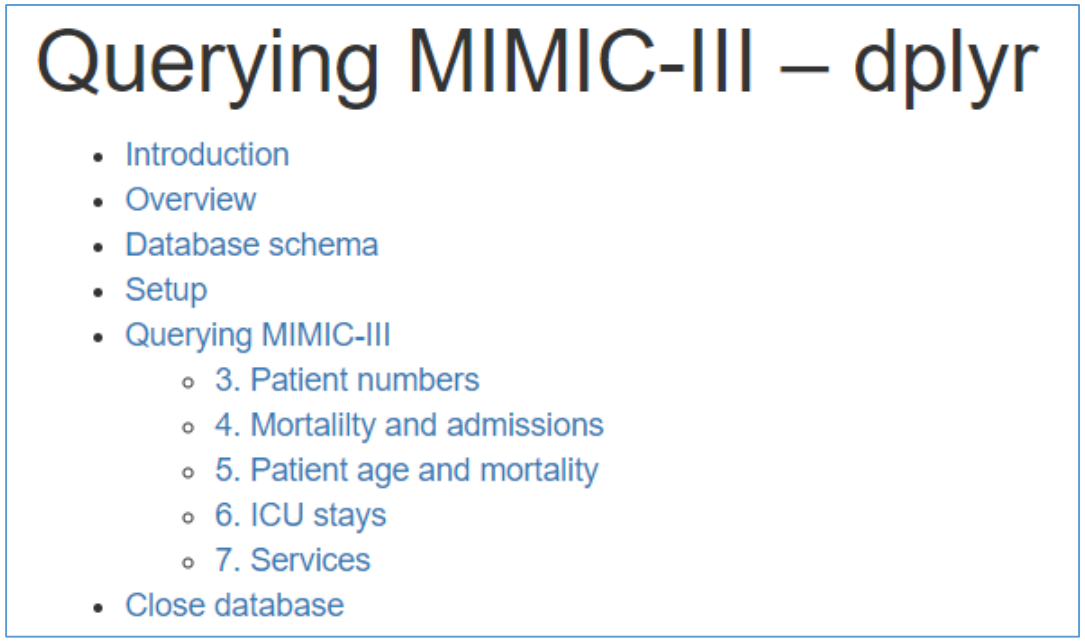
Querying MIMIC-III with SQL or R dplyr

RStudio Notebooks

Example 3. Patient Numbers

Querying-MIMIC-III-SQL.html

Querying-MIMIC-III-dplyr.html



Reproduced SQL examples, and showed utility of *dplyr* tidyverse approach.

https://mimic.physionet.org/tutorials/intro-to-mimic-iii/
050-Querying-MIMIC-III/Querying-MIMIC-III-SQL.html
050-Querying-MIMIC-III/Querying-MIMIC-III-dplyr.html

Getting Started with MIMIC-III

Querying MIMIC-III with SQL or R dplyr

Example 3. Patient Numbers

RStudio Notebooks Querying-MIMIC-III-SQL.html Querying-MIMIC-III-dplyr.html

SQL Chunk

```
```{sql, connection=MimicDB}
SELECT   gender, COUNT(*)
FROM     patients
GROUP BY gender
```
```

gender	count
M	26121
F	20399

```
library(tidyverse)
```

```
patients   <- tbl(MimicDB, in_schema("mimiciii", "patients"))
```

R Chunk

```
```{r}
patients                %>%
  group_by(gender)      %>%
  count()               %>%
  Show()
```
```

gender	n
M	26121
F	20399

magrittr “forward pipe” operators.

Read as “*then*”

050-Querying-MIMIC-III/Querying-MIMIC-III-SQL.html
050-Querying-MIMIC-III/Querying-MIMIC-III-dplyr.html

Notes

- Tidy Data
  https://vita.had.co.nz/papers/tidy-data.pdf
- Tidyverse
  https://rviews.rstudio.com/2017/06/08/what-is-the-tidyverse/
- R Markdown for Medicine
  https://rmd4medicine.netlify.com/

Getting Started with MIMIC-III

Querying MIMIC-III with SQL or R dplyr

Tutorial. Step 2

SQL

```
```{sql, connection=MimicDB, output.var="SQLresults"}
```

Step 2

Using the patients table retrieve the calculated age of patients.

```
SELECT
  ie.subject_id,
  ie.hadm_id,
  ie.icustay_id,
  ie.intime,
  ie.outtime,
  ROUND((cast(ie.intime as date) - cast(pat.dob as date))/365.242, 2) AS age_years
FROM
  icustays ie

  INNER JOIN patients pat
  ON ie.subject_id = pat.subject_id;
```

```
dim(SQLresults)
```

```
[1] 61532     6
```

dplyr

```
icustays   <- tbl(MimicDB, in_schema("mimiciii", "icustays"))
patients   <- tbl(MimicDB, in_schema("mimiciii", "patients"))
```

Step 2

Using the patients table retrieve the calculated age of patients.

```
results2 <-
  icustays                                                              %>%
  inner_join(patients, by="subject_id")                                 %>%
  select(subject_id, hadm_id, icustay_id, intime, outtime, dob)         %>%
  collect()                                                             %>%
  mutate(ageYears = (as.numeric(floor_date(intime, unit="day") -
                                floor_date(dob,    unit="day"),
                                units="days")  /  365.242)  %>%  round(2))  %>%
  select(-dob)
```

```
dim(results2)
```

```
[1] 61532     6
```

DB

R

dbplyr uses "lazy evaluation." `collect` forces computation of database query.

Calculated ages

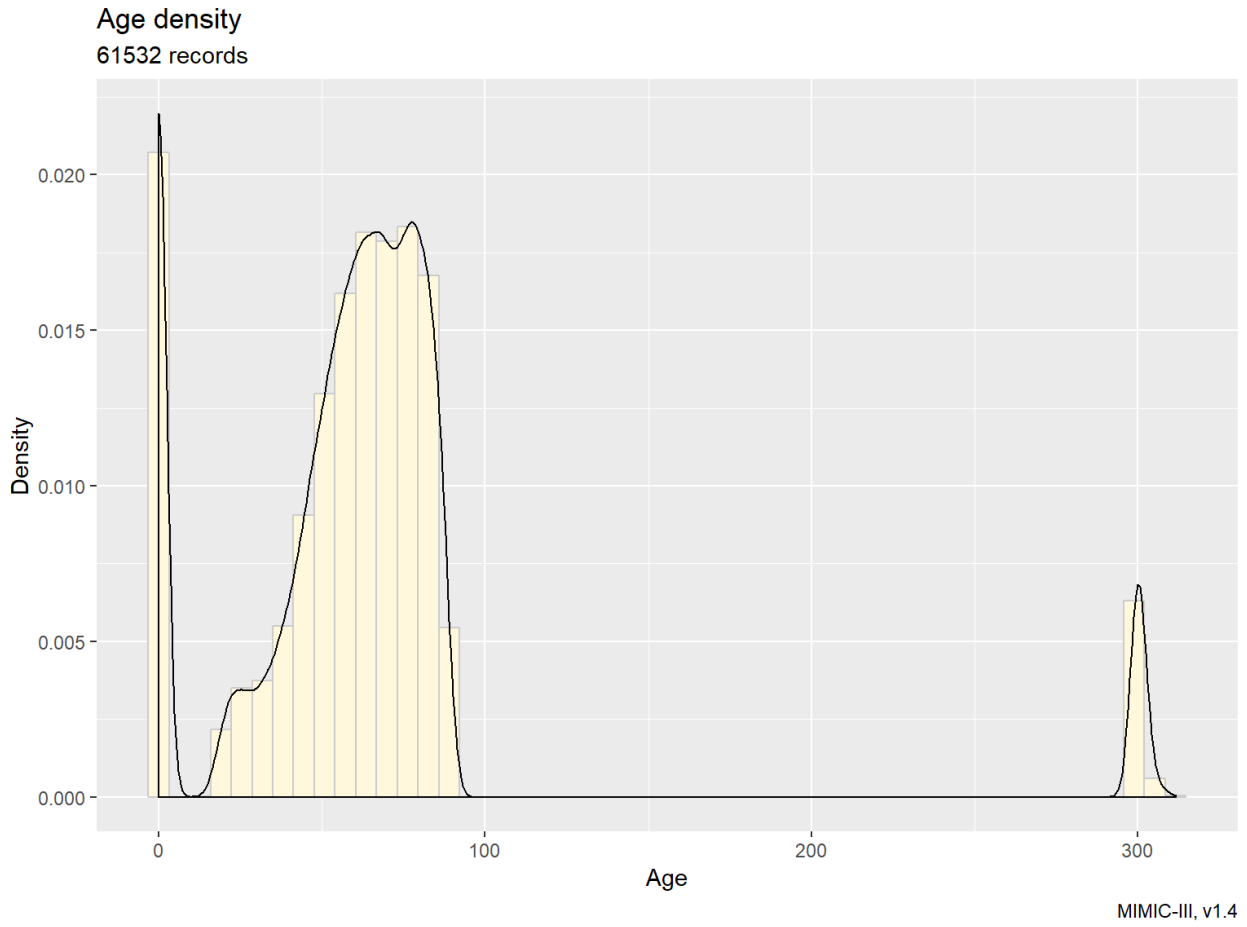
subject_id	hadm_id	icustay_id	intime	outtime	ageYears
268	110404	280836	2198-02-14	2198-02-18	65.98
269	106296	206613	2170-11-05	2170-11-08	40.10
270	188028	220345	2128-06-24	2128-06-27	80.08

https://mimic.physionet.org/tutorials/intro-to-mimic-iii/
050-Querying-MIMIC-III/Querying-MIMIC-III-Tutorial-Problem-SQL.html
050-Querying-MIMIC-III/Querying-MIMIC-III-Tutorial-Problem-Tidyverse-dplyr.html
```

Getting Started with MIMIC-III

Querying MIMIC-III with SQL or R dplyr

Tutorial. Step 2



050-Querying-MIMIC-III/Querying-MIMIC-III-Tutorial-Problem-SQL.html
050-Querying-MIMIC-III/Querying-MIMIC-III-Tutorial-Problem-Tidyverse-dplyr.html

Children's Mercy

MIMIC-III Explorations

- Patients Table
- Diagnoses Tables
- LabEvents Table

https://github.com/EarlGlynn/MIMIC-III-Exploration

MIMIC-III Explorations

Patients Table

RStudio Notebook

MIMIC-III Patients Table

Create your own detailed data dictionary.

patients/Patients.html

1.3 Open database

```
MimicDB <- dbConnect(RPostgres::Postgres(),
                     dbname   = "mimic",
                     user     = Sys.getenv("MIMIC_User"),
                     password = Sys.getenv("MIMIC_Password"),
                     bigint   = "integer",
                     options  = "-c search_path=mimiciii")
```

3 Sample patients

```
patients <- tbl(MimicDB, in_schema("mimiciii", "patients"))

patients          %>%
  head(10)        %>%
  Show()
```

row_id	subject_id	gender	dob	dod	dod_hosp	dod_ssn	expire_flag
234	249	F	2075-03-13	NA	NA	NA	0
235	250	F	2164-12-27	2188-11-22	2188-11-22	NA	1

4 Record count

```
patients             %>%
  summarize(n = n()) %>%
  Show()
```

n
46520

Children's Mercy

MIMIC-III Explorations

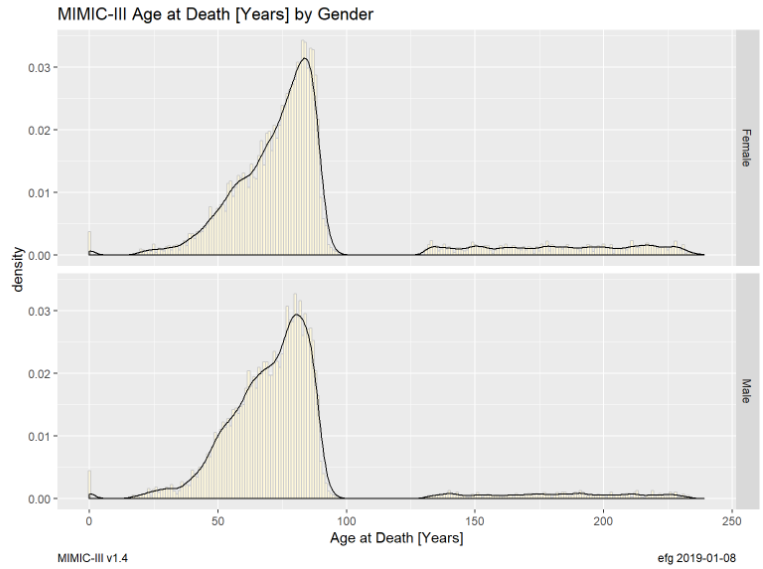
Patients Table

5.8 Computed: Age at Death [INCORRECT results with RPostgres]

```
facetLabels <- c(`F` = "Female",
                 `M` = "Male")
```

```
patients                                    %>%
  filter(expire_flag == 1)                  %>%
  select(-dod_hosp, -dod_ssn, -expire_flag)   %>%
  collect()                                 %>%
  mutate(AgeAtDeathYears = as.double(dod - dob)/ (86400 * 365.25) )  %>%

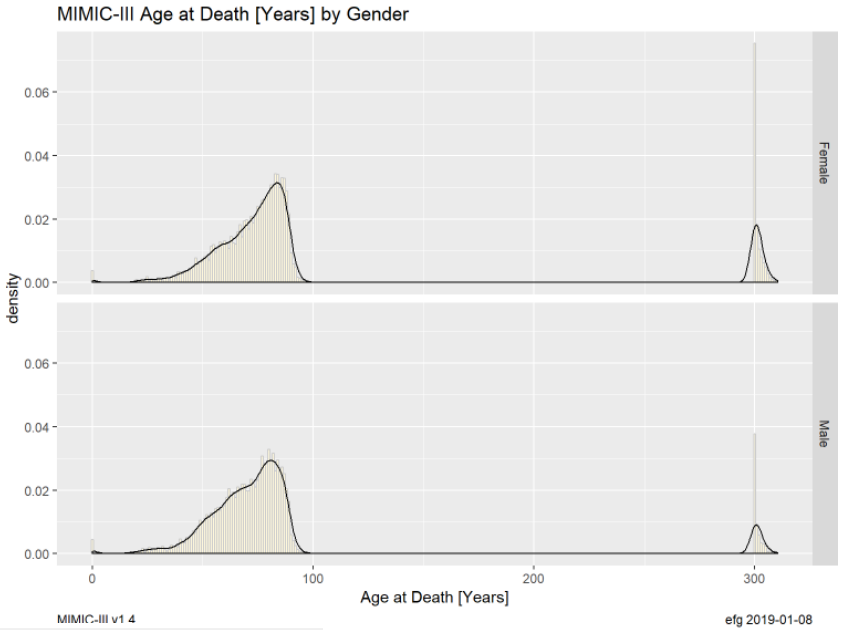
  ggplot(aes(x = AgeAtDeathYears, y = ..density..))            +
    geom_histogram(fill="cornsilk", color="grey80", binwidth=1) +
    geom_density()                                             +
    facet_grid(gender ~ ., labeller = as_labeller(facetLabels)) +
    labs(title="MIMIC-III Age at Death [Years] by Gender",
         x = "Age at Death [Years]",
         caption=c(plotCaptionLeft, plotCaptionRight))         +
    theme(plot.caption = element_text(hjust=c(0.0,1.0)))
```



7.1 Computed: Age at Death [CORRECT results with RPostgreSQL]

```
patients                                    %>%
  filter(expire_flag == 1)                  %>%
  select(-dod_hosp, -dod_ssn, -expire_flag)   %>%
  collect()                                 %>%
  mutate(AgeAtDeathYears = as.double(dod - dob)/ (86400 * 365.25) )  %>%

  ggplot(aes(x = AgeAtDeathYears, y = ..density..))            +
    geom_histogram(fill="cornsilk", color="grey80", binwidth=1) +
    geom_density()                                             +
    facet_grid(gender ~ ., labeller = as_labeller(facetLabels)) +
    labs(title="MIMIC-III Age at Death [Years] by Gender",
         x = "Age at Death [Years]",
         caption=c(plotCaptionLeft, plotCaptionRight))         +
    theme(plot.caption = element_text(hjust=c(0.0,1.0)))
```



patients/Patients.html

krimir

Confirmed that this is a bug in *RPostgres*. Should be fixed with the next update, planned end of February.

Children's Mercy

MIMIC-III Explorations

Summarize Diagnoses Counts: Top 10

4.1 Summarize Diagnoses Counts

```
diagnosesCounts <-
  factDiagnoses                       %>%
  filter(!is.na(icd9_code))           %>%
  group_by(icd9_code)                 %>%
  count()                             %>%
  ungroup()                           %>%
  left_join(dimDiagnoses,
            by = "icd9_code")         %>%
  select(n, everything(), -row_id)    %>%
  arrange(desc(n))                    %>%
  collect()

nrow(diagnosesCounts)
```

```
[1] 6984
```

Many of the ICD 9 diagnoses codes in the dimension table are never referenced.

4.1.1 Top 10

```
diagnosesCounts %>% head(10) %>% Show()
```

n	icd9_code	short_title	long_title
20703	4019	Hypertension NOS	Unspecified essential hypertension
13111	4280	CHF NOS	Congestive heart failure, unspecified
12891	42731	Atrial fibrillation	Atrial fibrillation
12429	41401	Crnry athrscl natve vssl	Coronary atherosclerosis of native coronary artery
9119	5849	Acute kidney failure NOS	Acute kidney failure, unspecified
9058	25000	DMII wo cmp nt st uncntr	Diabetes mellitus without mention of complication, type II or unspecified type, not stated as uncontrolled
8690	2724	Hyperlipidemia NEC/NOS	Other and unspecified hyperlipidemia
7497	51881	Acute respiratry failure	Acute respiratory failure
6555	5990	Urin tract infection NOS	Urinary tract infection, site not specified
6326	53081	Esophageal reflux	Esophageal reflux

diagnoses_icd/Diagnoses.html

Summarize Diagnoses by Age Intervals

4.3.2 Counts by diagnosis and age interval

```
admitAgesCounts <-
  factDiagnoses                                    %>%
  inner_join(factPatients,
             by = "subject_id")                    %>%
  inner_join(factAdmissions,
             by = c("subject_id",
                    "hadm_id"))                    %>%
  select(subject_id, hadm_id, icd9_code, dob, admittime)  %>%
  collect()                                                %>%   # extract data from DB
  mutate(                                                        # normal R processing
          delta         = admittime - dob,
          admitAgeYears = as.numeric((admittime - dob)) / ( 365.25 * 86400),  # seconds
          ageInterval   = pmin(90, 10 * admitAgeYears %/% 10)    # age decades; 90 is 90+
        )                                          %>%
  group_by(icd9_code, ageInterval)                 %>%
  count()                                          %>%  # counts in long format
  ungroup()                                        %>%
  arrange(icd9_code, ageInterval)                  %>%
  spread(ageInterval, n, fill=0)                   %>%  # long to wide format
  mutate(RowTotal = rowSums(.[-1], na.rm=TRUE))    %>%
  select(icd9_code, RowTotal, everything())        %>%  # reorder variables
  arrange(desc(RowTotal))                          %>%  # descending order
  left_join(dimDiagnoses, by = "icd9_code",              # add code labels
            copy = TRUE)                           %>%  # table to tibble
  select(-row_id)                                  %>%  # remove a variable
  rename( "0s"= "0", "10s"="10", "20s"="20", "30s"="30",
         "40s"="40", "50s"="50", "60s"="60", "70s"="70",
         "80s"="80", "90+"="90")                         # slightly better names

nrow(admitAgesCounts)
```

```
[1] 6985
```

diagnoses_icd/Diagnoses.html

MIMIC-III Explorations

Summarize Diagnoses by Age Intervals

```
admitAgesCounts  %>%
  head(5)        %>%
  Show()
```

icd9_code	RowTotal	0s	10s	20s	30s	40s	50s	60s	70s	80s	90+	short_title	long_title
4019	20703	13	6	109	433	1489	3479	5035	5184	3744	1211	Hypertension NOS	Unspecified essential hypertension
4280	13111	13	7	67	208	644	1500	2722	3527	3161	1262	CHF NOS	Congestive heart failure, unspecified
42731	12891	0	2	19	71	316	1138	2652	3961	3496	1236	Atrial fibrillation	Atrial fibrillation
41401	12429	0	0	6	135	614	1815	3241	3488	2431	699	Crnry athrscl natve vssl	Coronary atherosclerosis of native coronary artery
5849	9119	4	7	169	307	707	1424	1777	2088	1837	799	Acute kidney failure NOS	Acute kidney failure, unspecified

Can be a “shopping” list to identify research cohorts.

diagnoses_icd/Diagnoses.html
MIMIC-III-Diagnoses-Counts-by-Age-Intervals-Edited.xlsx

MIMIC-III Explorations

Labevents

- 27,854,055 lab values
- 3,100,249 with missing units
- 1,002,385 missing LOINC; some duplicate LOINCs
- Needs cleanup for consistency
- 3 categories

category	n	nFluid	nLOINC	nLabel
Blood Gas	4,998,026	2	29	33
Chemistry	10,983,768	8	232	278
Hematology	11,872,261	9	319	270

```
fixedLabEvents <-
  factLabEvents                                          %>%
  collect()                                              %>%

  mutate(
          valueuom = recode(valueuom,
                            "MEQ/L"    = "mEq/L",
                            "MG/DL"    = "mg/dL",
                            "MM HG"    = "mm Hg",
                            "MOSM/KG"  = "mOsm/kg",
                            "ng/dl"    = "ng/dL",
                            "NG/DL"    = "ng/dL",
                            "ng/ml"    = "ng/mL",
                            "nG/mL"    = "ng/mL",
                            "nG/ML"    = "ng/mL",
                            "RATIO"    = "Ratio",
                            "SECONDS"  = "sec",
                            "uG/DL"    = "ug/dL",
                            "ug/ml"    = "ug/mL",
                            "UNITS"    = "units",
                            .missing   = "<missing>"
                           )
        )
```

Used "majority vote" to resolve case differences

labevents/
labevents-FirstLook.html
labevents.html

Labevents

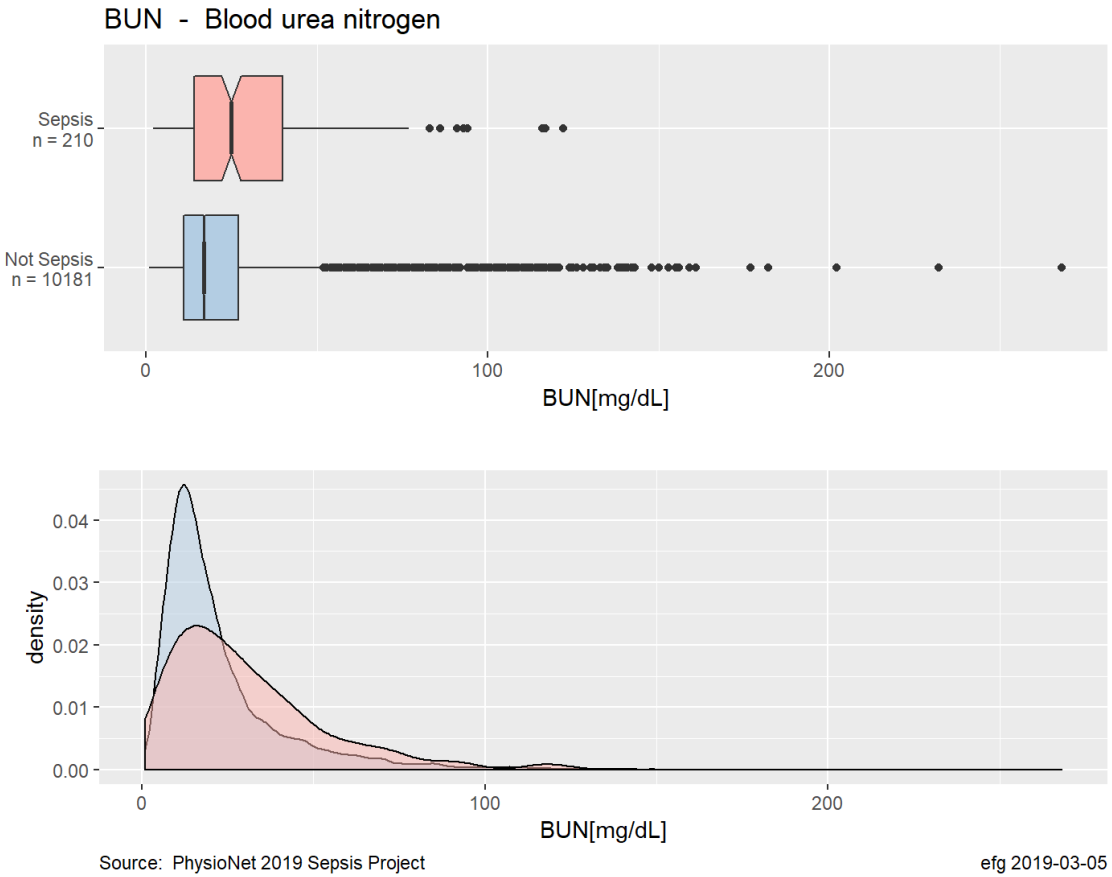
Top 20

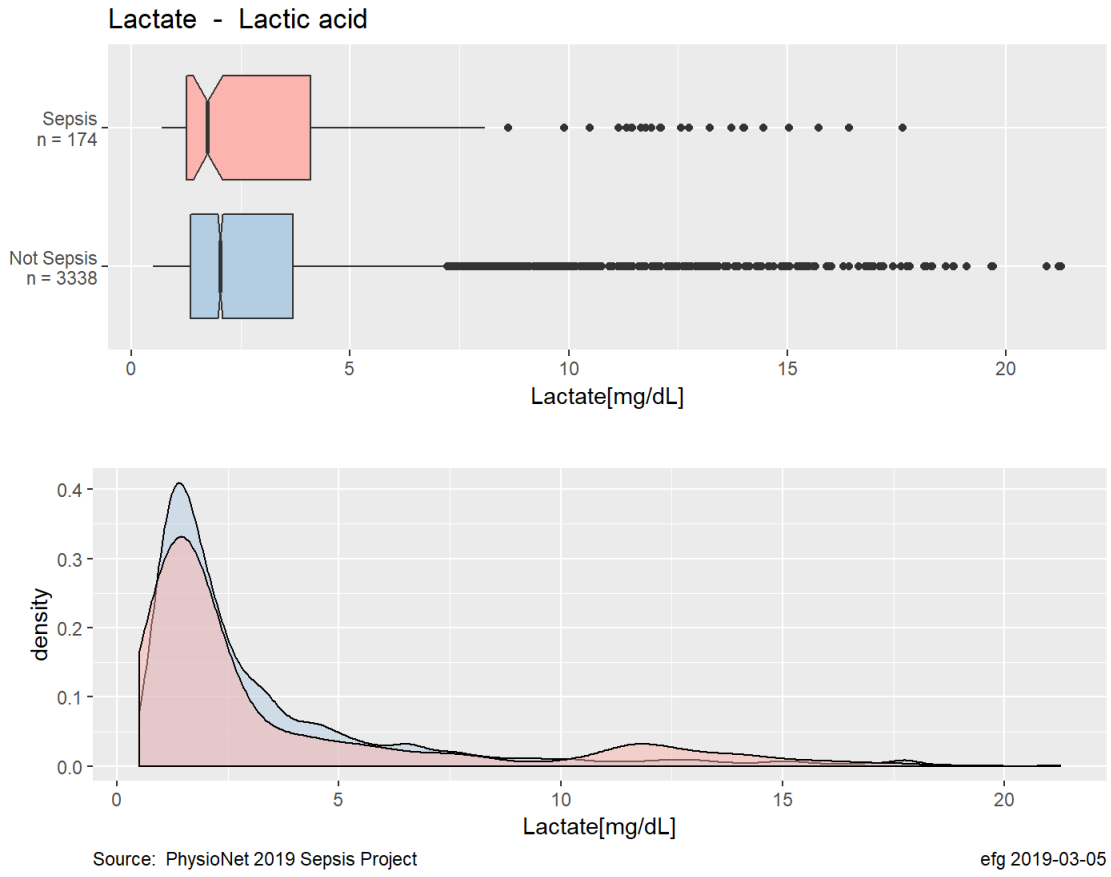
1	n	loinc_code	itemid	label	nUnits	Units
2	881,764	4544-3	51221	Hematocrit	2	%|<missing>
3	845,737	2823-3	50971	Potassium	2	mEq/L|<missing>
4	808,401	2951-2	50983	Sodium	2	mEq/L|<missing>
5	797,389	2160-0	50912	Creatinine	2	mg/dL|<missing>
6	795,480	2075-0	50902	Chloride	2	mEq/L|<missing>
7	791,838	3094-0	51006	Urea Nitrogen	2	mg/dL|<missing>
8	780,648	1963-8	50882	Bicarbonate	2	mEq/L|<missing>
9	778,365	777-3	51265	Platelet Count	2	K/uL|<missing>
10	769,810	1863-0	50868	Anion Gap	2	mEq/L|<missing>
11	753,221	804-5	51301	White Blood Cells	2	K/uL|<missing>
12	752,444	718-7	51222	Hemoglobin	2	g/dL|<missing>
13	748,896	2345-7	50931	Glucose	2	mg/dL|<missing>
14	748,147	786-4	51249	MCHC	2	%|<missing>
15	747,999	789-8	51279	Red Blood Cells	2	m/uL|<missing>
16	747,994	785-6	51248	MCH	2	pg|<missing>
17	747,977	787-2	51250	MCV	2	fL|<missing>
18	746,817	788-0	51277	RDW	2	%|<missing>
19	664,123	2601-3	50960	Magnesium	2	mg/dL|<missing>
20	591,932	2000-8	50893	Calcium, Total	2	mg/dL|<missing>
21	590,502	2777-1	50970	Phosphate	2	mg/dL|<missing>
...						
728	**27,854,055**	**TOTAL**				

labevents/
labevents.html, Section 3.7.1
Lab-Event-Item-Counts.xlsx

MIMIC-III Explorations

Labevents





~~labevents~~
https://github.com/EarlGlynn/PhysioNet-Sepsis-Challenge
030-Descriptive-Stats/LaboratoryValues-Stats.html

Children's Mercy

Outline

- What is MIMIC-III?
- MIMIC-III: Research and Education
- Getting Started with MIMIC-III
- MIMIC-III Explorations
- Machine Learning Using MIMIC-III
- Other PhysioNet Resources
- Take Home

Machine Learning with MIMIC-III

SCIENTIFIC DATA

OPEN

ANALYSIS

Multitask learning and benchmarking with clinical time series data

Received: 10 January 2019
Accepted: 24 May 2019
Published online: 17 June 2019

Hrayr Harutyunyan[1], Hrant Khachatrian[2,3], David C. Kale[1], Greg Ver Steeg[1] & Aram Galstyan[1]

Health care is one of the most exciting frontiers in data mining and machine learning. Successful adoption of electronic health records (EHRs) created an explosion in digital clinical data available for analysis, but progress in machine learning for healthcare research has been difficult to measure because of the absence of publicly available benchmark data sets. To address this problem, we propose four clinical prediction benchmarks using data derived from the publicly available Medical Information Mart for Intensive Care (MIMIC-III) database. These tasks cover a range of clinical problems including modeling risk of mortality, forecasting length of stay, detecting physiologic decline, and phenotype classification. We propose strong linear and neural baselines for all four tasks and evaluate the effect of deep supervision, multitask training and data-specific architectural modifications on the performance of neural models.

https://www.ncbi.nlm.nih.gov/pubmed/31209213, June 2019
Code: https://zenodo.org/record/1306527#.XYgY-yhKjYY

Children's Mercy

Machine Learning with MIMIC-III

Proceedings — AMIA Joint Summits on Translational Science

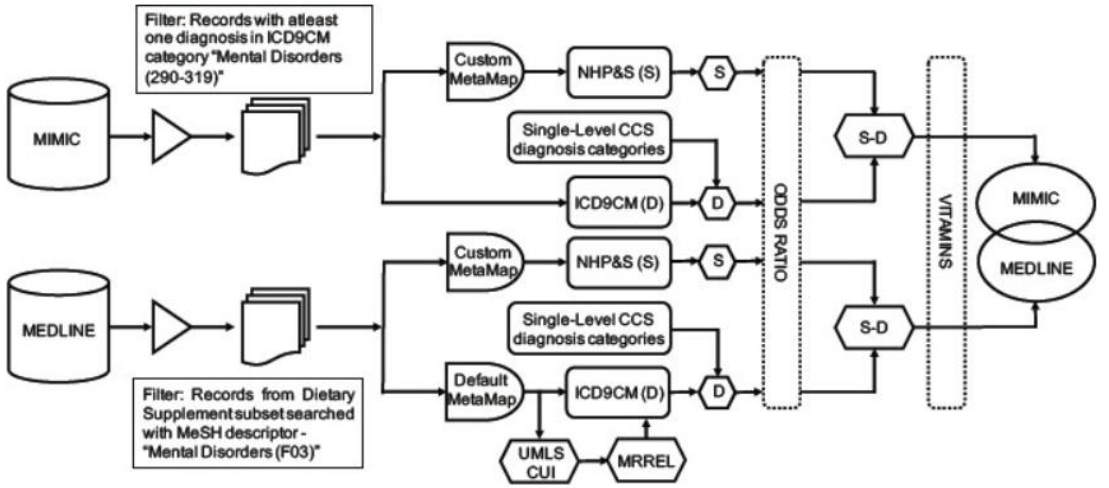
AMIA INFORMATICS PROFESSIONALS. LEADING THE WAY.

AMIA Jt Summits Transl Sci Proc. 2018; 2018: 196–205.
Published online 2018 May 18.

PMCID: PMC5961809
PMID: 29888071

Identifying Supplement Use Within Clinical Notes: An Applicationof Natural Language Processing

Vivekanand Sharma, PhD and Indra Neil Sarkar, PhD, MLIS



This study explored the feasibility to uncover patterns in the use of supplements, focusing on vitamin use among patients diagnosed with mental illness within patient records from the MIMIC-III database..

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5961809/, May 2018

Children's Mercy

Machine Learning with MIMIC-III

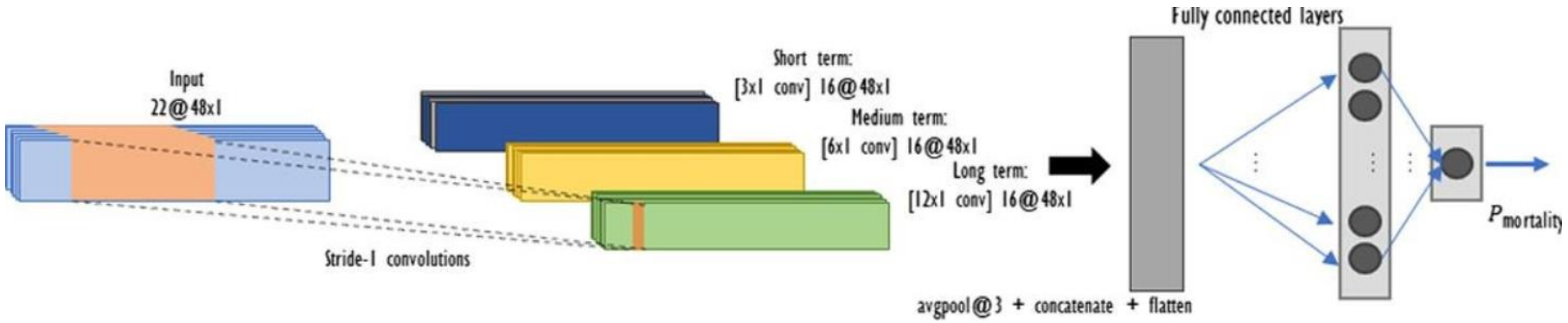
ELSEVIER

Journal of Biomedical Informatics

Volume 98, October 2019, 103269

ISeeU: Visually interpretable deep learning for mortality prediction inside the ICU

William Caicedo-Torres [a, b], Jairo Gutierrez [a]



https://www.ncbi.nlm.nih.gov/pubmed/31430550
August 2019

Children's Mercy

Machine Learning with MIMIC-III

sensors

MDPI

Article

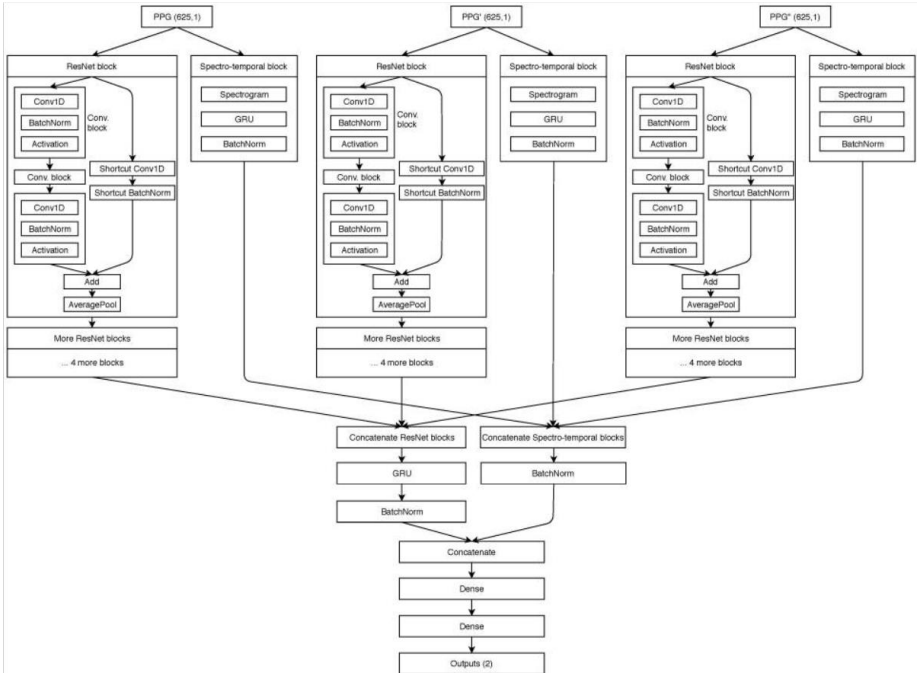
Blood Pressure Estimation from Photoplethysmogram Using a Spectro-Temporal Deep Neural Network

Gašper Slapničar [1,*], Nejc Mlakar [2] and Mitja Luštrek [1,3]

1 Jožef Stefan Institute, 1000 Ljubljana, Slovenia
2 Faculty of Computer and Information Science, University of Ljubljana, 1000 Ljubljana, Slovenia
3 Jožef Stefan International Postgraduate School, 1000 Ljubljana, Slovenia
* Correspondence: gasper.slapnicar@ijs.si

Received: 3 July 2019; Accepted: 2 August 2019; Published: 4 August 2019

check for updates



We analyzed the MIMIC III database for high-quality PPG and arterial BP waveforms, resulting in over 700 h of signals after preprocessing, belonging to 510 subjects.

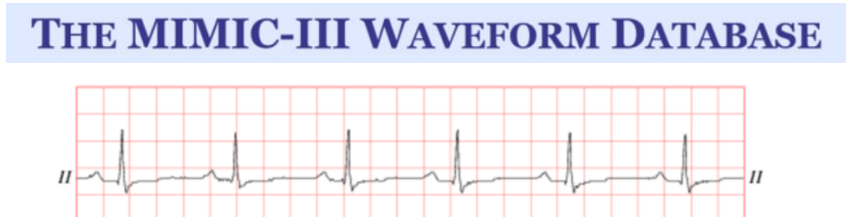
https://www.ncbi.nlm.nih.gov/pubmed/31382703, August 2019

Children's Mercy

Other PhysioNet Resources

https://physionet.org/

- MIMIC-III Waveform Database
  https://archive.physionet.org/physiobank/database/mimic3wdb/



- MIMIC Chest X-Ray Database
  https://physionet.org/content/mimic-cxr/2.0.0/

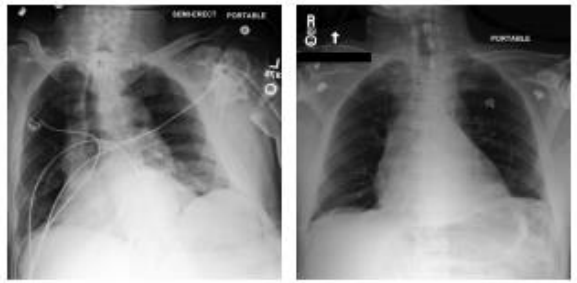
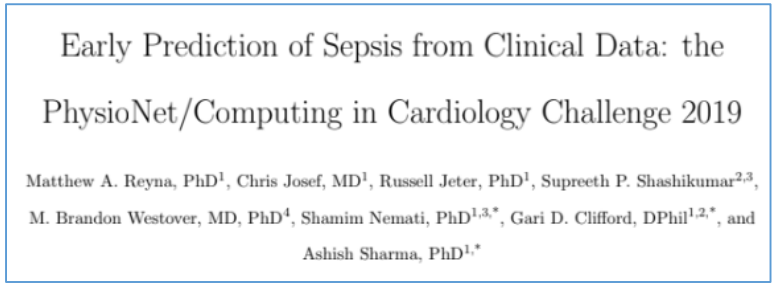


Figure 1: Images which exhibit variation in MIMIC-CXR. F

- 2019 PhysioNet Challenge
  Slides/Posters



Early Prediction of Sepsis from Clinical Data: the PhysioNet/Computing in Cardiology Challenge 2019

Matthew A. Reyna, PhD[1], Chris Josef, MD[1], Russell Jeter, PhD[1], Supreeth P. Shashikumar[2,3], M. Brandon Westover, MD, PhD[4], Shamim Nemati, PhD[1,3,*], Gari D. Clifford, DPhil[1,2,*], and Ashish Sharma, PhD[1,*]

Reyna MA, Josef C, Jeter R, Shashikumar SP, M. Brandon Westover MB, Nemati S, Clifford GD, Sharma A. Early prediction of sepsis from clinical data: the PhysioNet/Computing in Cardiology Challenge 2019. Critical Care Medicine, in press.

Children's Mercy

Take Home

- MIMIC-III is a great EHR data source for research projects and data science experiments, including predictive analytics projects.

- Will MIMIC-III be updated in 2019?

Children's Mercy