FYS: AI in Healthcare

Supervised Learning Case Studies

John Lalor

September 25, 2018

Admin & Followup

- Assignments

Admin & Followup

- Assignments
    - Formatting

Admin & Followup

- Assignments
    - Formatting
- Midterm project

Admin & Followup

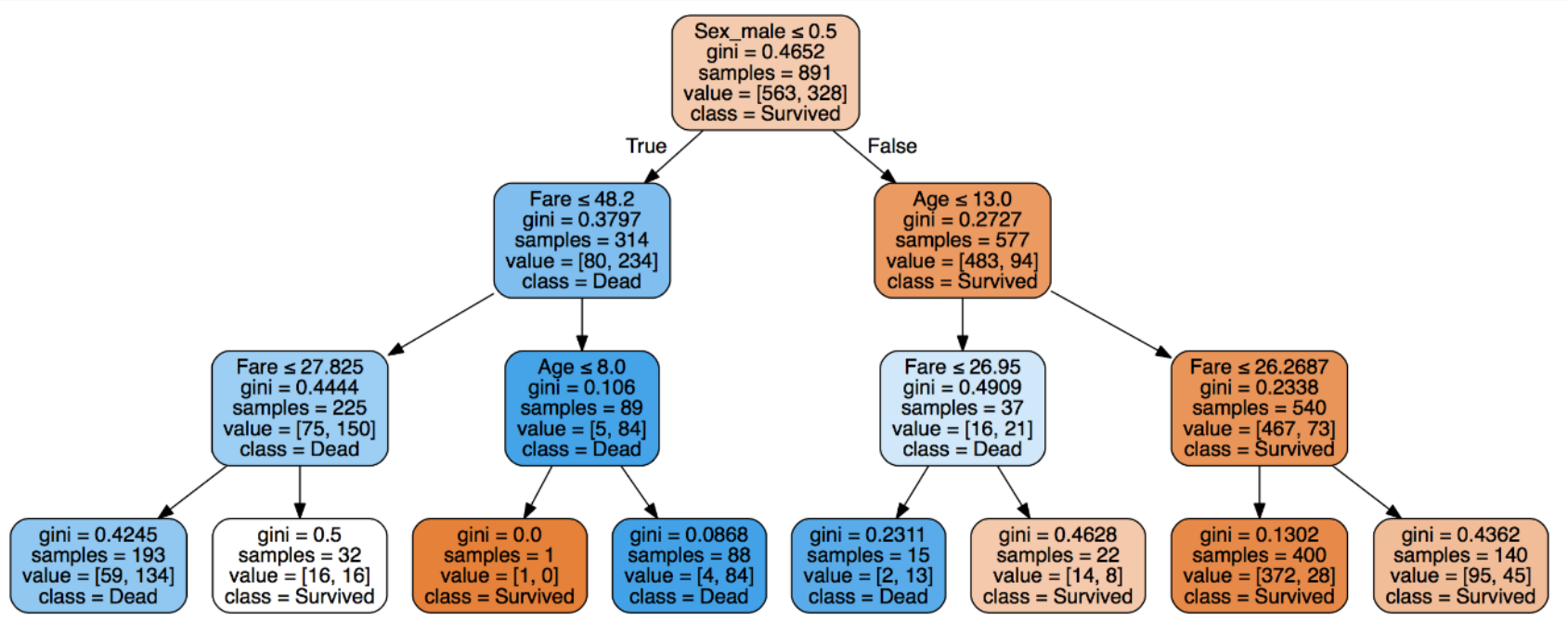
- Assignments
    - Formatting
- Midterm project
- ELIZA followup

Admin & Followup

- Assignments
  - Formatting
- Midterm project
- ELIZA followup
  - Center for Counseling and Psychological Help: `https://www.umass.edu/counseling/`

Supervised learning continued

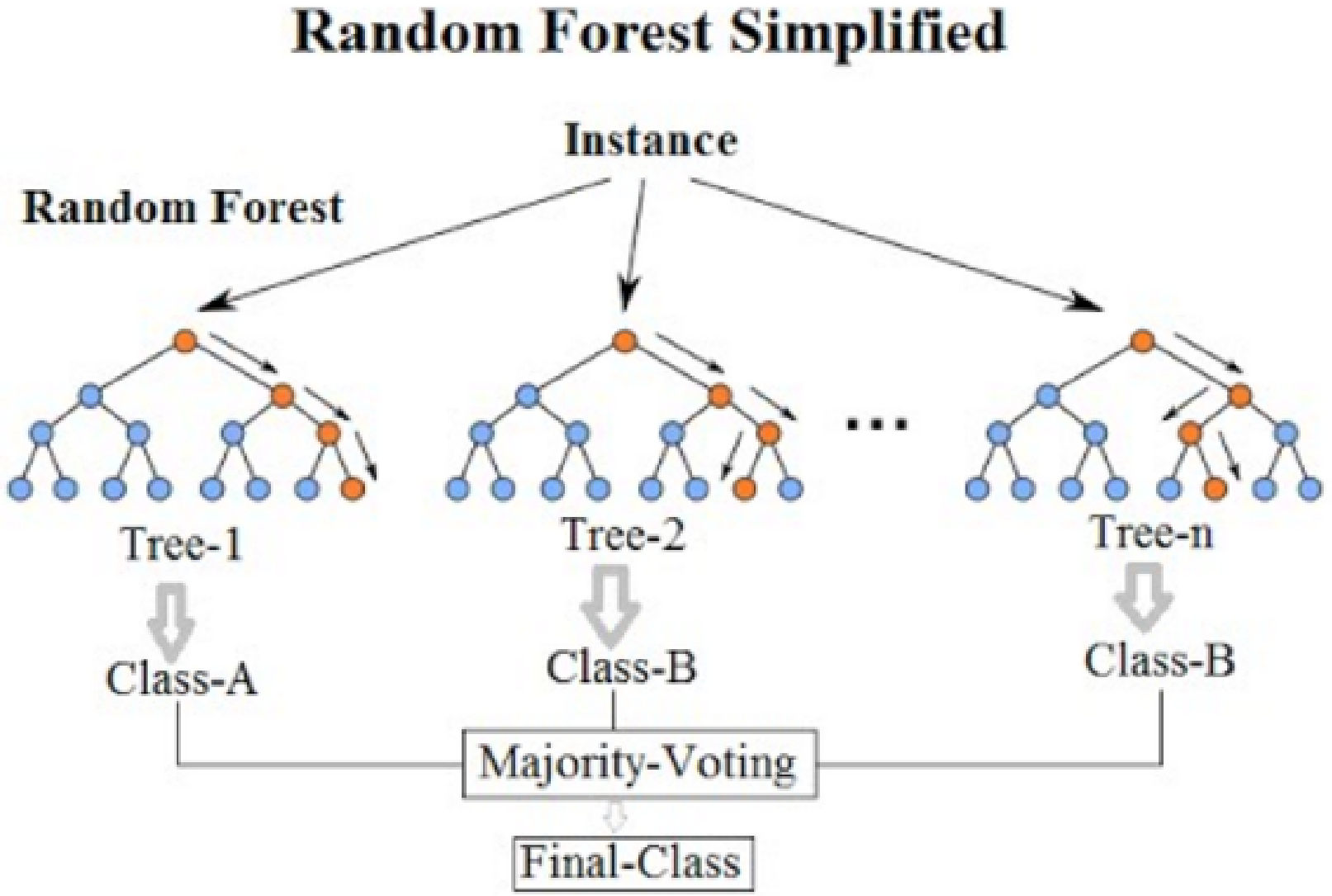
Decision tree



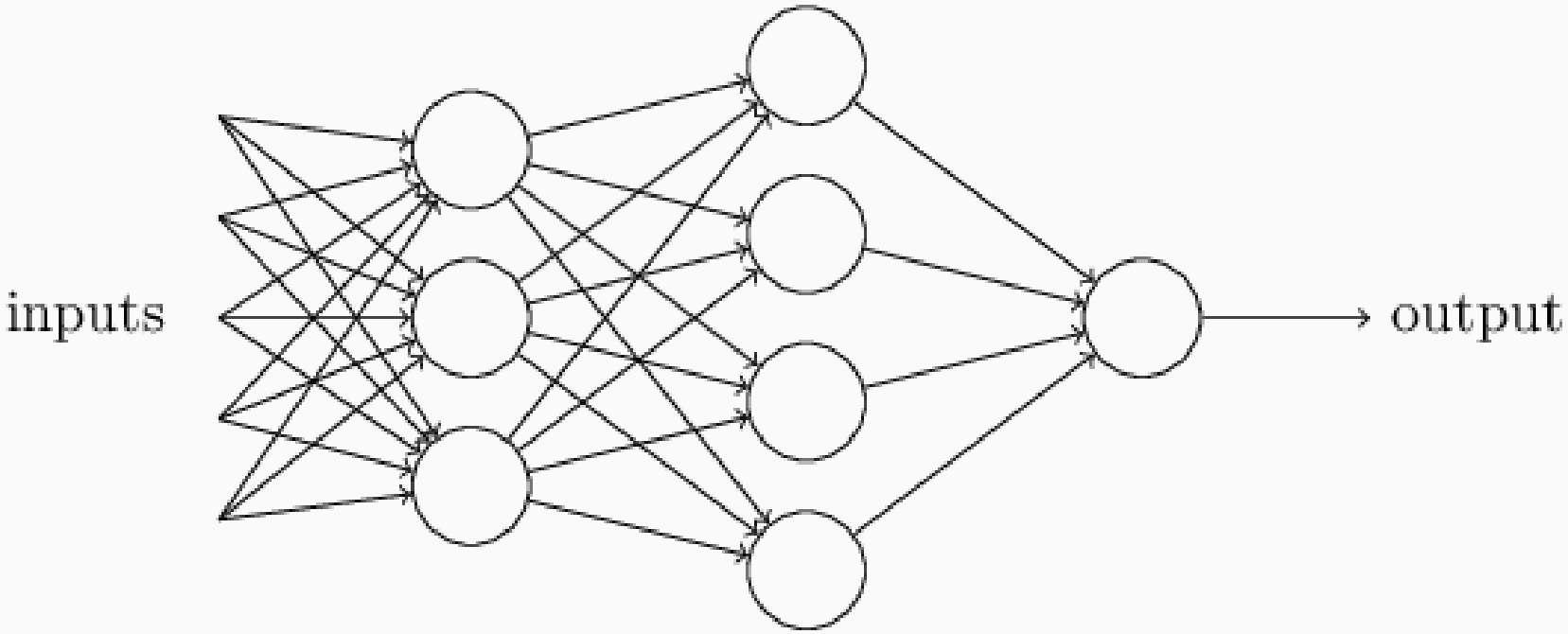
---

https://www.datacamp.com/community/tutorials/kaggle-tutorial-machine-learning

Random forest



Neural network



http://neuralnetworksanddeeplearning.com/chap1.html

AIHC Case Studies

Questions to consider

What are the risks/benefits of using AI here?

What questions would you have for your doctor before incorporating this into your care?

What questions should your doctor have for the researcher who built/trained the model before it is used on patients?

Hot off the press: Opthamology

Referral decisions from optical coherence tomography (OCT) scans

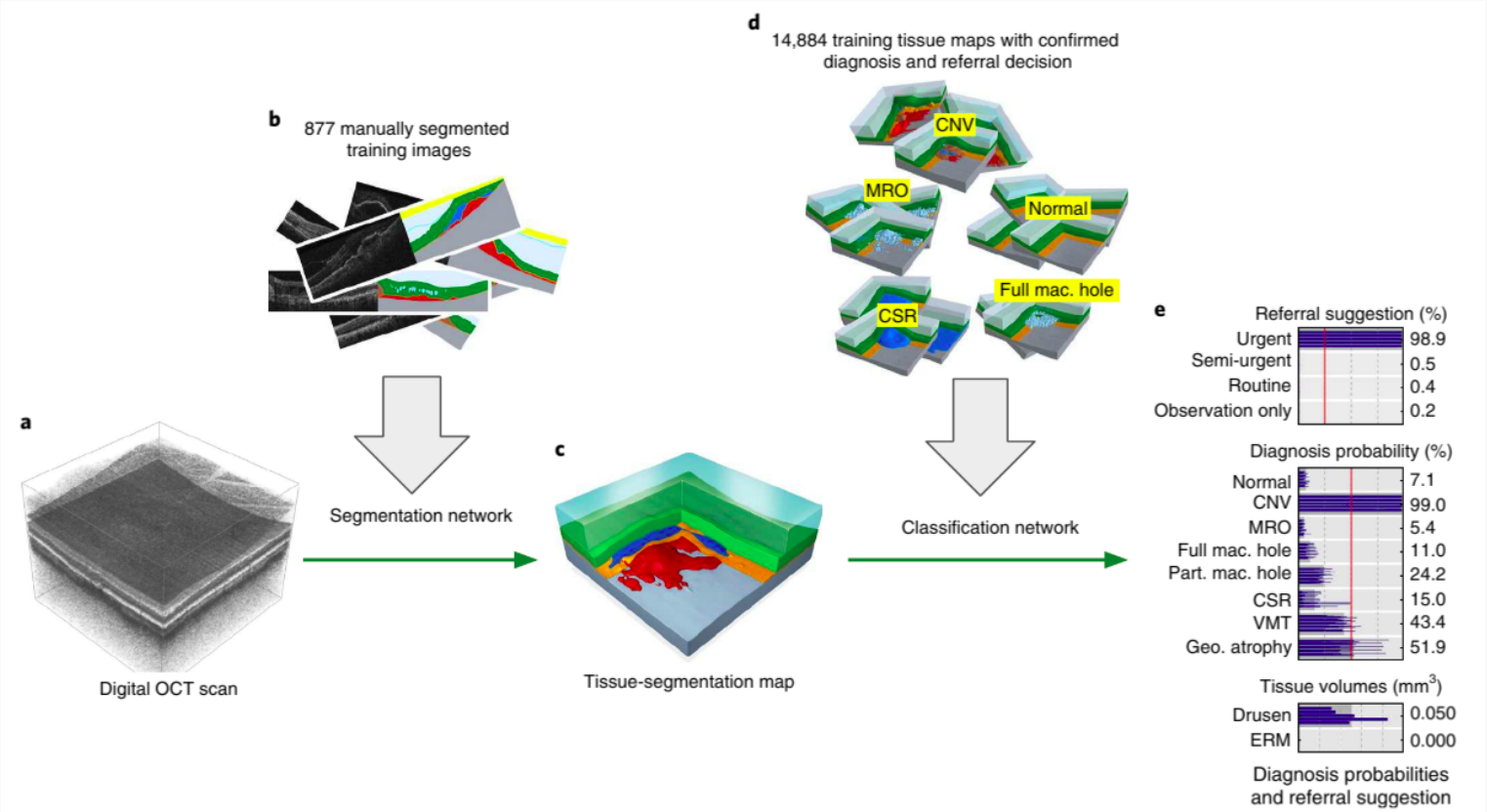
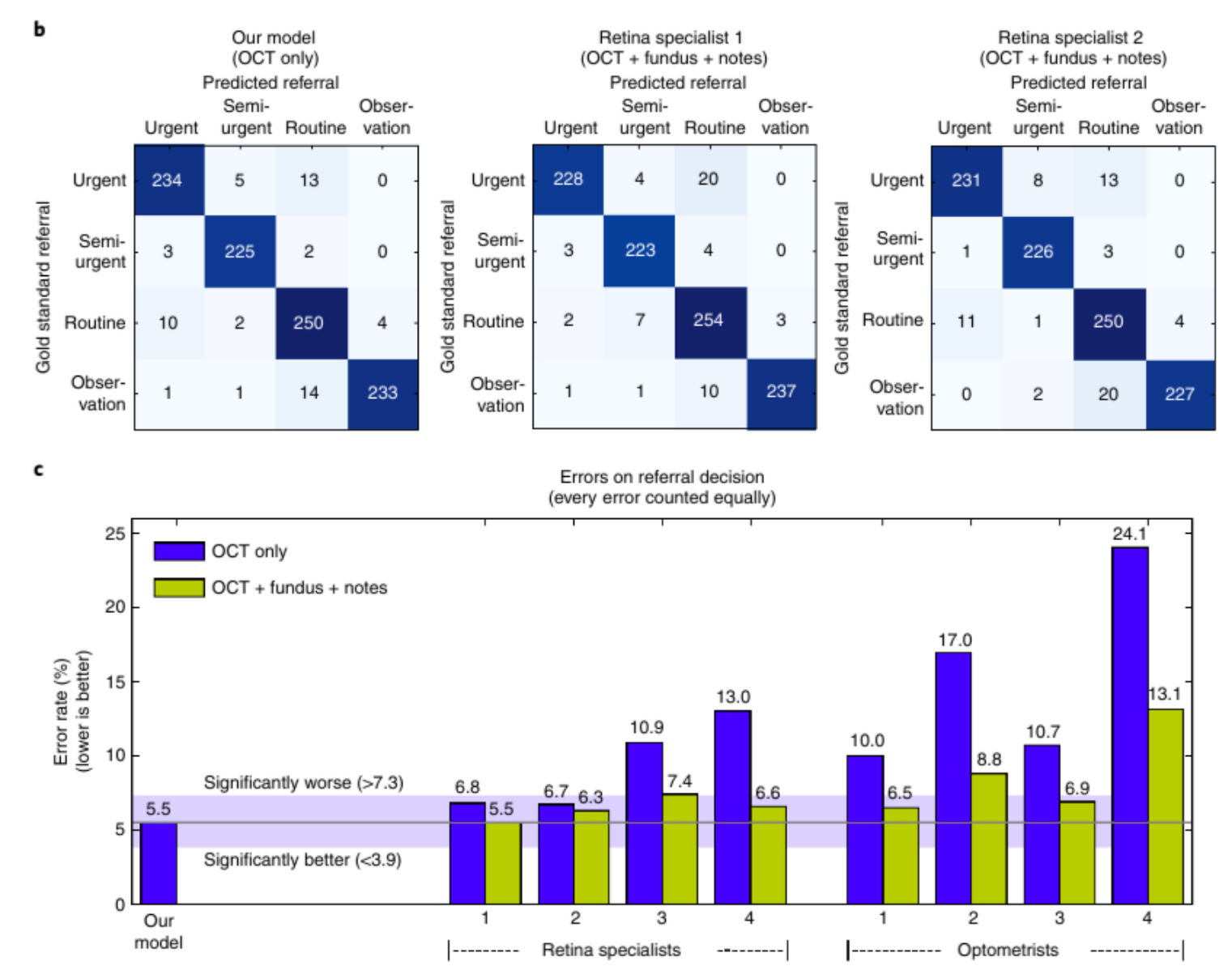


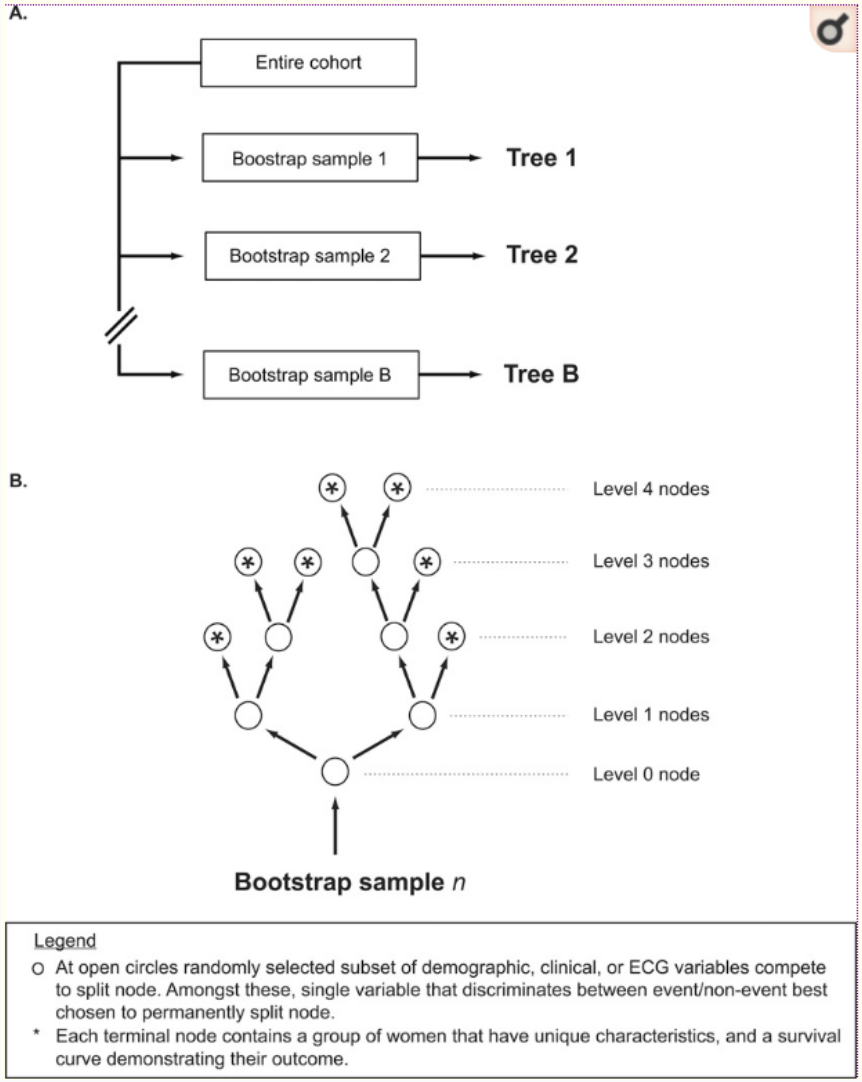
Fig. 1 | Our proposed AI framework. a, Raw retinal OCT scan ($6 \times 6 \times 2.3\,mm^3$ around the macula). **b**, Deep segmentation network, trained with manually segmented OCT scans. **c**, Resulting tissue segmentation map. **d**, Deep classification network, trained with tissue maps with confirmed diagnoses and optimal referral decisions. **e**, Predicted diagnosis probabilities and referral suggestions.

De Fauw, Jeffrey, et al. "Clinically applicable deep learning for diagnosis and referral in retinal disease." Nature medicine 24.9 (2018): 1342.

Hot off the press: Opthamology

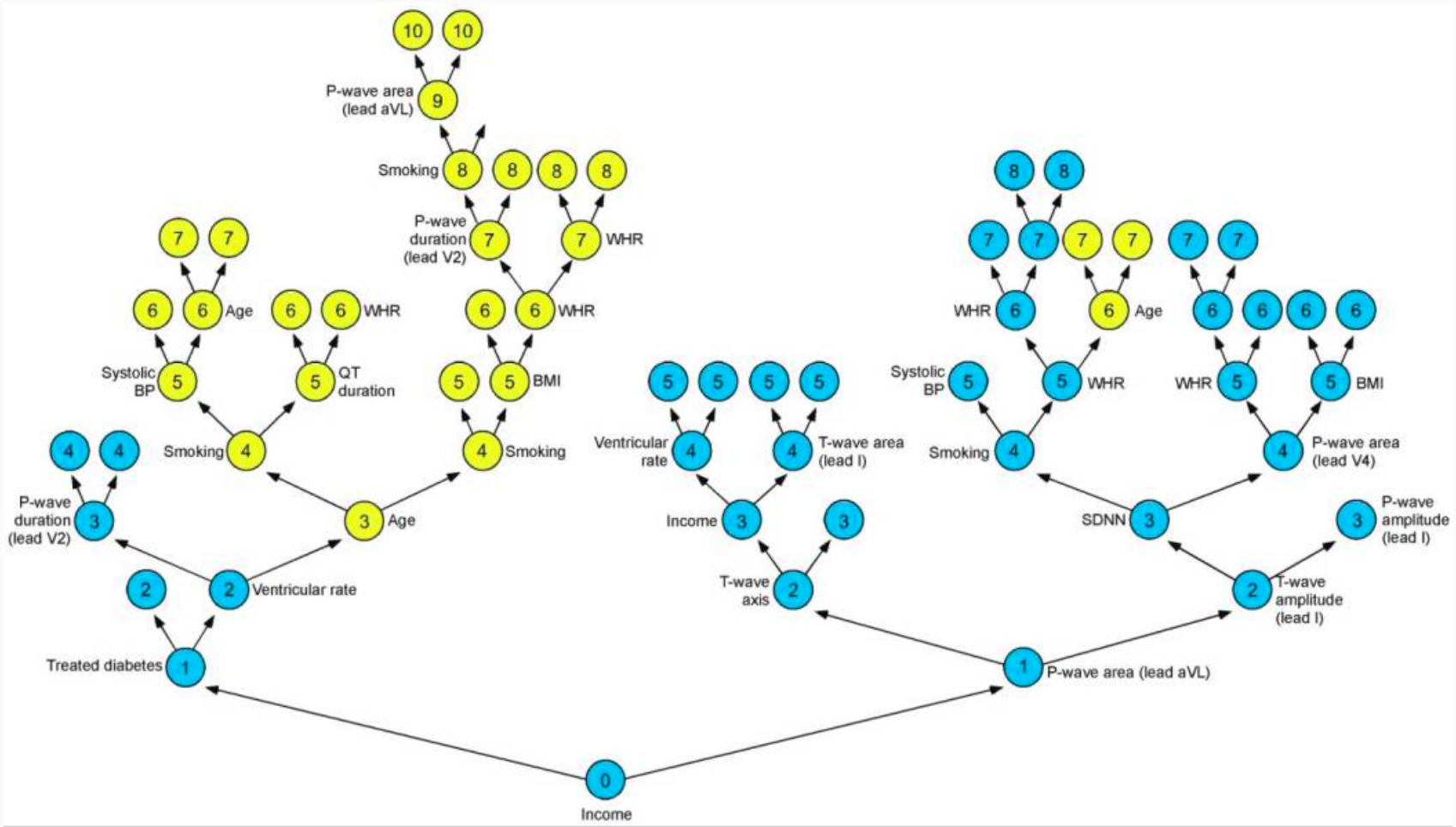


Mortality prediction



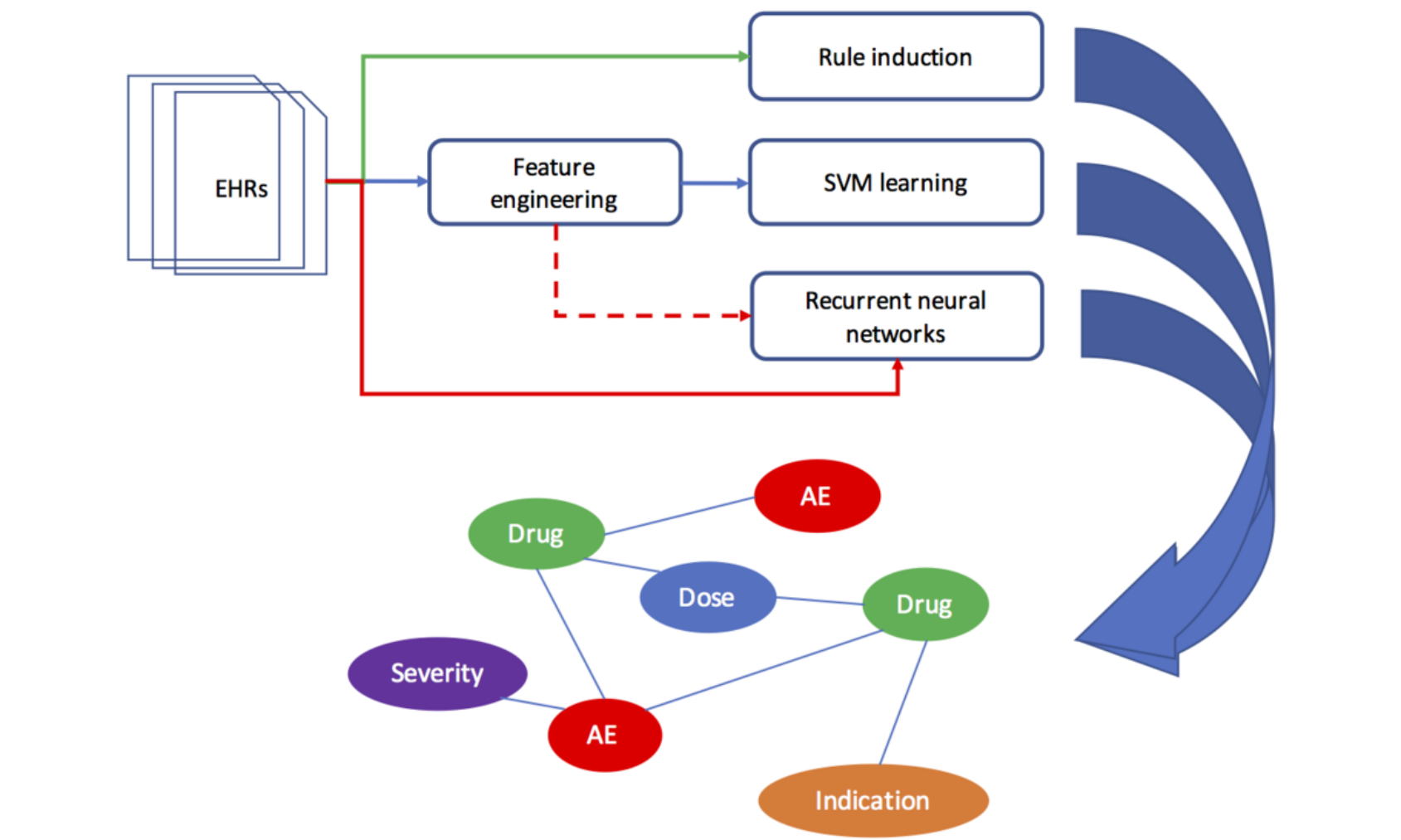
Gorodeski, Eiran Z., et al. "Use of hundreds of electrocardiographic biomarkers for prediction of mortality in postmenopausal women." Circulation: Cardiovascular Quality and Outcomes 4.5 (2011): 521-532.

Mortality prediction



Gorodeski, Eiran Z., et al. "Use of hundreds of electrocardiographic biomarkers for prediction of mortality in postmenopausal women." Circulation: Cardiovascular Quality and Outcomes 4.5 (2011): 521-532.

Adverse drug event detection



Munkhdalai T, et al., Clinical Relation Extraction Toward Drug Safety Surveillance Using Electronic Health Record Narratives: Classical Learning Versus Deep Learning JMIR Public Health Surveill 2018;4(2):e29

Adverse drug event detection

Results (%) of the best performing support vector machines model on test set. Keep rate=0.8.

Relation	Precision	Recall	F1-score
None	100	100	100
Dosage	85	91	88
Route	96	97	96
Frequency	93	97	95
Duration	89	93	91
Indication	72	77	75
Adverse	85	84	85
Severity	95	94	95
Overall	87.85	90.42	89.1

Munkhdalai T, et al., Clinical Relation Extraction Toward Drug Safety Surveillance Using Electronic Health Record Narratives: Classical Learning Versus Deep Learning JMIR Public Health Surveill 2018;4(2):e29

Activity: Nearest Neighbors

Warm-up

Training set: 1, 7, 13

Test set: 3, 17

$k = 1$

Round 1

Training set: 1, 2

Test set: 14, 16

$k = 1$

Round 2

Training set: 5, 15

Test set: 4, 12

$k = 2$

Round 3

Training set: 3

Test set: 13

$k = 1$

Round 4

Training set: 17

Test set: 6

$k = 1$

Round 5

Training set: 8, 10, 11, 12, 18

Test set: 9, 19

$k = 3$

Round 6

Training set: 6

Test set: 7

$k = 1$