## **Supplementary information**

# Open resource of clinical data from patients with pneumonia for the prediction of COVID-19 outcomes via deep learning

In the format provided by the authors and unedited

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**Supplementary Fig. 1 | The most significantly increased and decreased CFs. a,b,** The most significantly increased (a) (Body temperature, P = 2.26E-29) and decreased (b) (RDWCV, P = 1.33E-15) CFs in COVID-19 patients (Type I & II, n = 894) against control cases (n = 328). **c,d,** The most significantly increased (c) (Neutrophil percent, P = 1.20E-26) and decreased (d) (Lymphocyte percent, P = 1.70E-25) CFs in Type II patients (n = 274) against Type I cases (n = 620). **e,f,** The most significantly increased (e) (Neutrophil percent, P = 5.31E-17) and decreased (f) (Lymphocyte percent, P = 1.79E-16) CFs in deceased cases (n = 57) against cured cases (n = 662). Box plots denote median and 25th to 75th percentiles (boxes) and 10th to 90th percentiles (whiskers). The data of these CFs did not follow the normal distribution (Supplementary Data 1), and *p*-values were calculated by the two-sided Mann-Whitney U test.

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INUST-Union Hospital INUST-Union Hospital	Padent 44 Padent 45 Padent 66 Padent 66 Padent 66 Padent 67 Padent 67 Padent 67 Padent 67 Padent 77 Padent 77 Padent 70 Padent	60 78 64 86 91 61 64 66 65 71 65 71 65 71 65 71 65 71 65 71 65 73 Male 38.5°C Aorta ca	Make Male Permale Male Male Permale Permale Permale Permale Permale Permale Permale Permale Permale	Positive Positive Positive Positive Positive Positive Positive Positive Positive Positive Positive	Positive Positive Positive Positive Positive Positive Positive Positive Positive Positive Positive Positive Positive	Bervite Servite Critical yi Servite Se	Unknown Decesard Unknown Decesard Curred Cur		Routine Block Text: Clinical feature Mean corpuscular hemogolon concentration Mean corpuscular hemogolon Hematocrit Hemogolon Rest blood cell Platelet distribution witht Platelet distribution Mean platelet volume Platelet curt Basophil count Basophil count Basophil count Basophil percent Basophil percent Basophil percent Monocyce parcent	Abbreviation           MCHC           MCH           MCV           HGT           HGB           RBC           PDW           PCT           MFV           PLT           BA           EO           MO           LY           NE           Bap           Eop           MO           LY           NE           Bap           Eop           Mop           Lyp	Value           337.00           307.00           91.30           40.960           138.00           4.48           16.20           0.23           0.03           0.03           0.03           0.03           0.03           0.50           0.50           0.60           0.60           5.80           13.8.90	Normal far           316-354 g           27-34 pg           27-34 pg           27-34 pg           27-34 pg           27-34 pg           310-175 g           310-175 g           310-175 g           310-175 g           310-175 g           310-175 g           311-172 0-172 g           310-30 G           01-08 G           01-18 G           0-1 %           0-1 %           0-1 %           0-1 %           0-10 %
INUST-Union Hospital INUST-Union HOSPITAL	Partnet 44 Partnet 45 Partnet 56 Partnet 56 Partnet 56 Partnet 56 Partnet 66 Partnet 66 Partnet 67 Partnet 76 Partnet 76 Partnet 76 Partnet 76 Partnet 710 Partnet	60 78 64 86 91 61 64 68 69 64 66 65 71 65 71 73 Male 38.5°C Aorta ca Positive Posi	Make Male Permale Male Male Permale Permale Permale Permale Permale Permale	Positive Positive Positive Positive Positive Positive Positive Positive Positive Positive Positive	Positive Positive Positive Positive Positive Positive Positive Positive Positive Positive Positive	Bevete Servete Critical yi Servete Ser	Urbinouni Deceared Urbinouni Deceared Curred		Routine Bioce Test: Clinical feature Mean corpuscular hemogolobi Mean corpuscular volume Mean corpuscular volume Hemotionit Rest blood cell Platelet distribution with Platelet clivit Mean platelet volume Platelet court Basophil court Eosimophil court Monocyte court Usympholy count Basophil court Basophil court Basophil court Basophil court Basophil court Basophil percent Monocyte percent Monocyte percent Neutophil percent	Abbreviation           MCHC           MCHC           MCHC           MCHC           MCV           MCT           HGB           RBC           PDT           MPV           PLT           BA           EO           MO           LY           NE           Bap           Eop           Mop           LSP           Nep           Nep           Nep	Value           337.00           30.700           30.701           91.30           40.90           138.00           448           1620           0.23           8.30           272.00           0.00           0.30           0.00           0.30           0.30           0.30           0.30           0.30           0.30           0.30           0.30           0.30           0.31           4.19           0.60           0.60           73.50           72.70 T	Normal ran           316-354 g           27-34 pg           27-34 pg           40-50 %           40-50 %           130-175 g           130-175 g           130-175 g           130-175 g           143-8 f1           159-172 '           0.1-0.28 f           0.1-0.28 f           0.1-0.26 g           0.1-0.86 g/           1.1-3.2 g/           0.4-8.0 %           3-10 %           3-10 %           2-0.00 %           2-0.00 %
INUST-Union Hospital INUST-Union Hospital	Padret 44 Padret 45 Padret 46 Padret 56 Padret 56 Padret 56 Padret 57 Padret 77 Padret 73 Padret 73 Padret 70 Padret	60 64 66 91 61 64 66 99 64 66 65 71 65 71 65 71 65 71 65 71 65 73 Male 38.5°C Aorta ca Positive Positive	Male Male Female Male Male Female Female Female Female Female Female Female	Positive Positive Positive Positive Positive Positive Positive Positive Positive Positive Positive	Positive Positive Positive Positive Positive Positive Positive Positive Positive Positive Positive	Bervite Servite Critical yill Servite Servite Servite Servite Servite Servite Servite Servite Servite Servite Servite Servite Servite Servite Servite Servite Servite Servite Servite	Urbinomi Decesed Urbinonn Decesed Curred Cur		Routine Bioce Text: Clinical feature Mean corpuscular hemogolon concentration Mean corpuscular hemogolon Mean corpuscular volume Hemotorit Hemogolon Rest blood cell Platelet datibusion width Platelet datibusion Platelet curit Basophil count Basophil count Basophil count Basophil count Basophil percent Eosinophil percent Eosinophil percent Monocyte percent Umphocyte percent Nettrophil percent Nettrophil percent Nettrophil percent Nettrophil percent	Abbreviation           MCHC           MCH           MCV           HCT           H08           RBC           PCT           MFV           PLT           BA           EO           MO           LY           Bap           Eop           Mop           Lyp           NE           Bap           Eop           Mop           Lyp           Nep           WBC	Value           337.00           307.00           91.30           40.90           138.00           44.8           16.20           0.23           0.03           0.03           0.03           0.71 j           4.19           0.60           0.60           0.60           13.80 j           79.70 f           5.80 j           79.70 f           5.25	Normal ran           316-354 g           27-34 pg           38-100 pg           39-175 pg           310-175 pg           310-175 pg           312-171 pg           312-350 G           012-052 G           0102-052 G           0102-052 G           0102-052 G           01-158 G           04-86 0%           3-10 %           20-05 %           3-55 6 G
HUST-Unice Hospital HUST-Unice Hospital	Patient 44 Patient 55	HUST-U 73 64 64 66 65 65 71 65 65 71 73 Male 38.5°C Aorta ca Positive Source	Male Male Pemale Male Male Female Female Female Female Female	Positive Positive Positive Positive Positive Positive Positive Positive Positive Positive Positive Positive Positive Positive Positive	Positive Positive Positive Positive Positive Positive Positive Positive Positive Positive Positive	Berete Servete Critical yill Servete Servete Servete Servete Servete Servete Servete Servete Servete Servete Servete Servete Servete Servete Servete	Urbinouni Deceased Urbinouni Deceased Curred		Routine Bioce Test: Clinical feature Mean corpuscular hemogobion Mean corpuscular volume Mean corpuscular volume Mean corpuscular volume Mean optimuscular working Red blood cell Platetel databution with Platetel scluttine Platetel count Basophil count Basophil count Monocyte count Neurophil count Basophil count Basophil count Basophil count Basophil count Monocyte parcent Monocyte parcent Monocyte parcent Neurophil percent Neurophil percent	Abbreviation           MCHC           MCHC           MCHC           MCHC           MCV           HGB           RBC           PDT           PCT           MPV           PLT           BA           EO           LY           NE           Bap           Eop           Mop           Lyp           Nep           VBC           PLCR	Value         337 00           337 70         91.30           91.30         91.30           40.90         138.00           138.00         138.00           4.48         152.00           0.30         272.00           0.30         0.00             0.30         0.07             4.19         0.60           0.00           3.50             772.01         5.25           13.50           19.70	Normal ran           316-354 g           27-34 pg           27-34 pg           40:00 %           40:00 %           40:00 %           40:00 %           40:00 %           40:00 %           40:00 %           10:07 %           0:00 %

**Supplementary Fig. 2 | The resource page of iCTCF database. a**, Multiple selection options were provided for searching the resource in a customizable manner. **b**, After clicking "Submit", the results returned in a tabular list. **c**, A general summary of a given patient in the overview section. **d**, One of five representative chest CT slices in JPEG format was displayed for each patient. The other slices could be seen by clicking horizontal scrolling buttons. **e**, The numerical CFs of a given patient were shown in a tabular list.



**Supplementary Fig. 3 | The accuracy for predicting morbidity or mortality outcomes exclusively using CT or CF data.** Both receiver operating characteristic (ROC) curves and confusion matrices were illustrated. **a**, CT-based prediction of morbidity outcomes using the Cohort 1 (207 controls, 384 Type I patients, and 149 Type II patients having CT data). **b**, CF-based prediction of morbidity outcomes using the Cohort 1 (222 controls, 438 Type I patients, and 211 Type II patients having CF data). **c**, CT-based prediction of morbidity outcomes using the Cohort 2 (106 controls, 180 Type I patients, and 56 Type II patients having CT data). **d**, CF-based prediction of morbidity outcomes using the Cohort 2 (106 controls, 180 Type I patients, and 56 Type II patients having CT data). **d**, CF-based prediction of morbidity outcomes using the Cohort 2 (106 controls, 180 Type I patients, and 56 Type II patients, and 63 Type II patients having CF data). **e**, CT-based prediction of mortality outcomes using the merged Cohort (593 cured and 19 deceased cases having CT data). **f** CF-based prediction of mortality outcomes using the merged Cohort (662 cured and 57 deceased cases having CF data).



**Supplementary Fig. 4 | The accuracy of Inception Net V3**<sup>36</sup> and ChexNet<sup>37</sup> for predicting morbidity or mortality outcomes using our CT data. Both ROC curves and confusion matrices were illustrated. **a,b**, The prediction of morbidity outcomes using the Cohort 1 based on Inception Net V3 (a) and ChexNet (b) (207 controls, 384 Type I patients, and 149 Type II patients having CT data). **c,d**, The prediction of morbidity outcomes using the Cohort 2 based on Inception Net V3 (c) and ChexNet (d) (106 controls, 180 Type I patients, and 56 Type II patients having CT data). **e,f**, The prediction of mortality outcomes using the merged Cohort based on Inception Net V3 (e) and ChexNet (f) (593 cured and 19 deceased cases having CT data).

#### **Description of the Supplementary Dataset**

#### **Supplementary Data 1**

The details on 9 classes and 130 types of CFs, including CF names, abbreviations, and normal range values in HUST-UH and HUST-LH. *a*. Before statistical analysis, the normality of data distribution was evaluated by the Shapiro-Wilk test for each CF. *b*. *p*-value > 0.05 denoted data following normal distribution, and there were 11 CFs following the normal distribution; *c*. *N*/A, not available; *d*. F/M, female or male.

#### Supplementary Data 2

The information regarding underlying diseases and morbidity outcomes of patients from HUST-UH or HUST-LH for the two cohorts.

#### **Supplementary Data 3**

The statistical comparisons of numerical CFs in different types of patients. In the sheet "Positive *vs.* Control", statistically higher and lower (Marked in grey) CFs were shown in cases with COVID-19 pneumonia against control patients. In the sheet "Type II *vs.* Type I", statistically higher and lower (Marked in grey) CFs were shown in Type II patients against Type I patients. In the sheet "Deceased *vs.* Cured", statistically higher and lower (Marked in grey) CFs were shown in Type II patients against Type I patients. In the sheet "Deceased *vs.* Cured", statistically higher and lower (Marked in grey) CFs were shown in deceased cases against cured patients. For the above three sheets, fold changes were present, while the two-sided unpaired t-test and Mann-Whitney U test were conducted for CF data following normal distribution or not, respectively (p-value <  $10^{-4}$ ). Adjusted *p*-values were calculated using the Benjamini-Hochberg method (<  $10^{-3}$  in this study). In the sheet "Underlying diseases", the proportions of patients with and without underlying diseases (Udis) were compared (Two-sided chi-squared test) between COVID-19 patients (Type I & II) and controls, between Type II and Type I patients, and between deceased and cured cases.

#### Supplementary Data 4

All pre-configured parameters in CNN and DNN frameworks. *a*. Input, size of an input image (height \* width \* channel); *b*. Convolutional, number and size of convolutional kernels (number \* height \* width); *c*. Pooling, size of a pooling layer (height \* width); *d*. Dense, number of nodes in the dense layer; *e*. Dropout, the dropout ratio; *f*. Output, number of nodes in the output layer; *g*. Decay, learning rate decay factor; *h*. Epochs, number of iterations.