

Forecasting the Worldwide Spread of COVID-19 based on Logistic Model and SEIR Model

Xiang Zhou¹, Xudong Ma², Na Hong³, Yingying Ma³, Jie He³, Huizhen Jiang⁴, Chun Liu³,
Guangliang Shan⁵, Longxiang Su¹, Weiguo Zhu^{4,6}, Shuyang Zhang⁷, Yun Long¹

¹Department of Critical Care Medicine, Peking Union Medical College Hospital, Peking
Union Medical College & Chinese Academy of Medical Sciences, Beijing 100730, China

²Department of Medical Administration, National Health Commission of the People's
Republic of China, Beijing, 100044, China.

³Digital China Health Technologies Co. Ltd., Beijing 100080, China

⁴Department of Information Management, Peking Union Medical College Hospital, Peking
Union Medical College & Chinese Academy of Medical Sciences, Beijing 100730, China

⁵Department of Epidemiology and Biostatistics, Institute of Basic Medicine Sciences, Chinese
Academy of Medical Sciences (CAMS) & School of Basic Medicine, Peking Union Medical
College, Beijing, 100730, China.

⁶Department of General Internal Medicine, Peking Union Medical College Hospital, Peking
Union Medical College & Chinese Academy of Medical Sciences, Beijing 100730, China

⁷Department of Cardiovascular Disease, Peking Union Medical College Hospital, Peking Union
Medical College & Chinese Academy of Medical Sciences, Beijing 100730, China

Appendix

A. Logistic Model Prediction Results Evaluation

We used data from 1-10 days, 12-21 days, and 14-23 days after the initiation time of each country as the time window for evaluation, and the following 1-7 days of reported data were collected for evaluation.

	Estimates number of cases (1-10 days)	Reported number of cases (1-10 days)	Error (1-10 days)	Estimates number of cases (12-21 days)	Reported number of cases (12-21 days)	Error (12-21 days)	Estimates number of cases (14-23 days)	Reported number of cases (14-23 days)	Error (14-23 days)
Iran (future 1- to 7-day prediction)	5386	5823	-437	7331	7161	170	9348	9000	348
	6003	6566	-563	7906	8042	-136	10,081	10,075	6
	6464	7161	-697	8332	9000	-668	10,687	11,364	-677
	6790	8042	-1252	8635	10,075	-1440	11,173	12,729	-1556
	7001	9000	-1999	8845	11,364	-2519	11,553	13,938	-2385
	7156	10,075	-2919	8988	12,729	-3741	11,844	14,991	-3147
	7250	11,364	-4114	9083	13,938	-4855	12,064	16,169	-4105
Italy (1- to 7-day prediction)	2963	3089	-126	5233	4636	597	7005	7375	-370
	3372	3858	-486	6517	5883	634	8328	9172	-844
	3718	4636	-918	8001	7375	626	9752	10,149	-397
	3993	5883	-1890	9668	9172	496	11,237	12,462	-1225
	4203	7375	-3172	11,476	10,149	1327	12,737	15,113	-2376
	4357	9172	-4815	13,365	12,462	903	14,203	17,660	-3457
	4467	10,149	-5682	15,267	15,113	154	15,590	21,157	-5567
Japan (1- to 7-day prediction)	269	274	-5	343	331	12	432	420	12
	280	293	-13	374	360	14	476	461	15
	290	331	-41	369	420	-51	524	502	22
	291	360	-69	407	461	-54	577	511	66
	306	420	-114	444	502	-58	635	581	54
	312	461	-149	483	511	-28	669	639	30
	317	502	-185	526	581	-55	685	639	46
South Korea (1- to 7-day prediction)	3784	3736	48	5060	5186	-126	6425	6088	337
	4590	4335	255	5661	5621	40	6675	6593	82
	5402	5186	216	6173	6088	85	6855	7041	-186
	6174	5621	553	6590	6593	-3	6982	7314	-332
	6868	6088	780	6916	7041	-125	7070	7478	-408

	7461	6593	868	7164	7314	-150	7232	7513	-281
	7945	7041	904	7348	7478	-130	7441	7755	-314
US (1- to 7-day prediction)	1660	1663	-3	2988	2727	261	4807	4632	175
	2217	2179	38	3969	3499	470	6203	6421	-218
	2953	2727	226	5244	4632	612	7929	7788	141
	3921	3499	422	6881	6421	460	10,017	13677	-3660
	5185	4632	553	8948	7788	1160	12,478	19,100	-6622
	6818	6421	397	11,508	13,677	-2169	15,292	25,493	-10201
	8904	7788	1116	14,601	19,100	-4499	18,402	26,231	-7829
Germany (1- to 7-day prediction)	2009	1908	101	3913	3675	238	6162	5795	367
	2531	2078	453	4953	4585	368	7701	7272	429
	3157	3675	-518	6139	5795	344	9481	9527	-46
	3891	4585	-694	7430	7272	158	11,474	12,327	-853
	4729	5795	-1066	8771	9527	-756	13,626	15,320	-1694
	5659	7272	-1613	10,093	12,327	-2234	15,863	19,848	-3985
	6658	9527	-2869	11,336	15,320	-3984	18,094	20,055	-1961
Spain (1- to 7-day prediction)	3240	2277	963	6541	6391	150	10,901	9942	959
	4542	5232	-690	7605	7798	-193	11,643	11,748	-105
	6269	6391	-122	9290	9942	-652	12,093	13,910	-1817
	8482	7798	684	12,760	11,748	1012	17,501	17,963	-462
	11,193	9942	1251	14,314	13,910	404	20,078	20,410	-332
	13,338	11,748	1590	16,856	17,963	-1107	22,134	24,926	-2792
	15,761	13,910	1851	18,856	20,410	-1554	23,664	28,572	-4908
France (1- to 7-day prediction)	2038	1784	254	2816	2281	535	4770	4469	301
	2558	2281	277	3445	3661	-216	5383	4499	884
	1540	2281	-741	4122	4469	-347	5884	6633	-749
	3104	3661	-557	4818	4499	319	8202	7652	550
	3637	4469	-832	5502	6633	-1131	9579	9043	536
	4127	4499	-372	6720	7652	-932	10,882	10,871	11

	4549	6633	-2084	7218	9043	-1825	12,053	12,612	-559
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B. Logistic fitting curves and model predictions (the initial date is the first day since the 100th confirmed case was reached, and the data reported from the initial date to March 20, 2020, of each country were used for model fitting)

Italy reached 100 on February 23, 50 days after the initial date, $r = 0.205$, value=97,442

Iran reached 100 on February 26, 38 days to peak after the initial date, $r = 0.216$, value=23,414

South Korea reached 100 on February 20, 25 days after the initial date, $r = 0.340$, value=8139

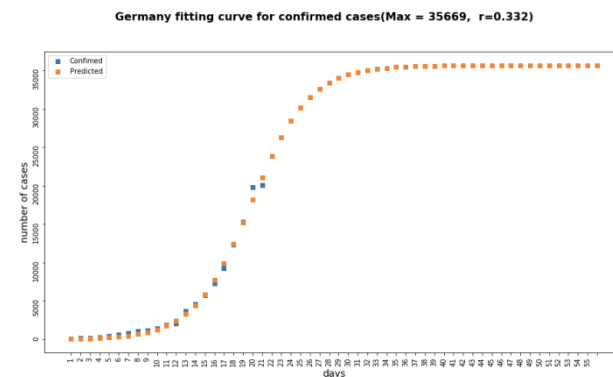
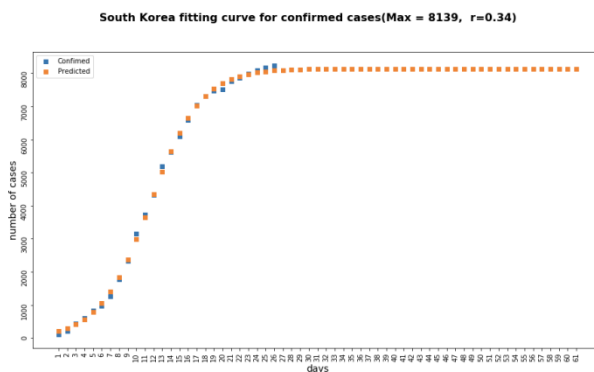
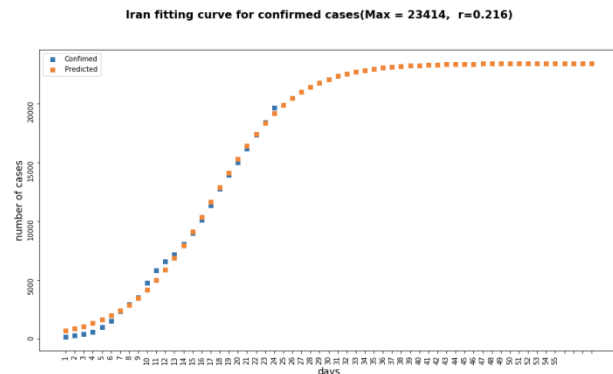
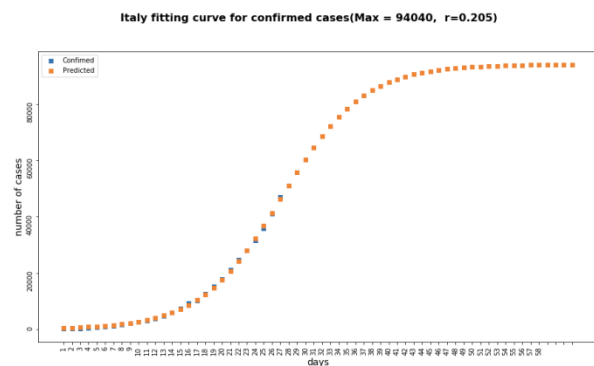
Germany, reached 100 on March 1, 49 days to peak after the initial date, $r = 0.263$, value=235,902

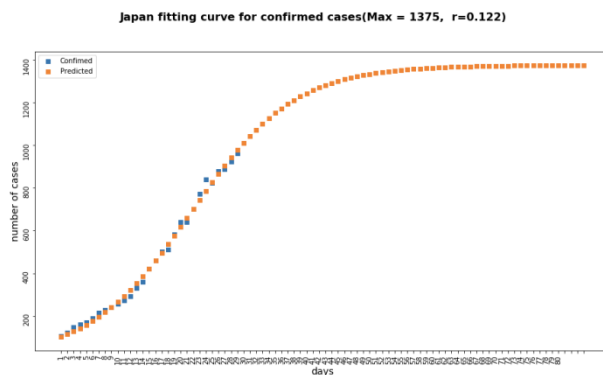
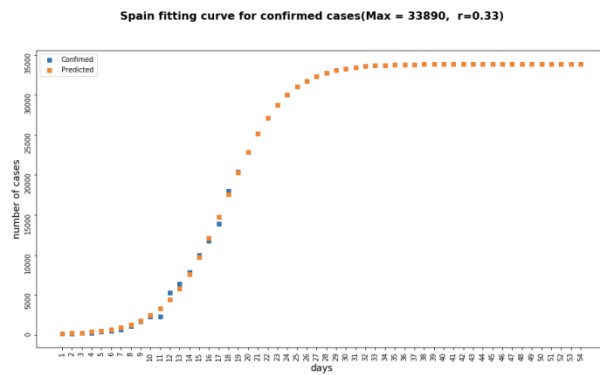
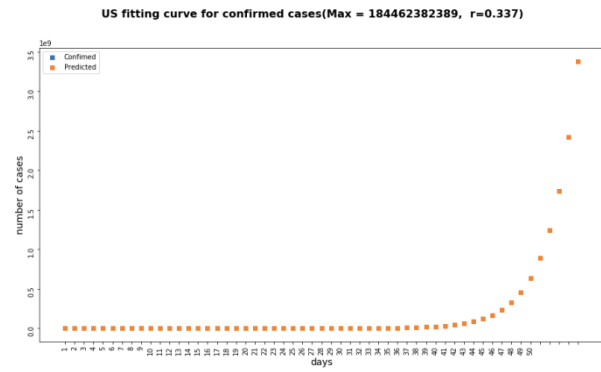
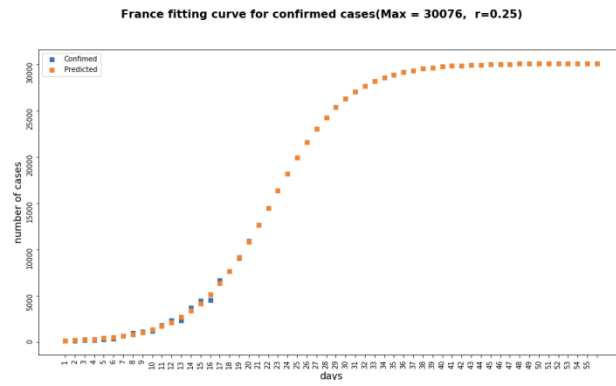
France reached 100 on February 29, 45 days after the initial date, $r = 0.250$, value=30,076

The US reached 100 on March 2, and current data failed to predict the peak, $r = 0.348$

Spain reached 100 at March 2, 32 days to peak after the initial date, $r = 0.33$, value=33,890

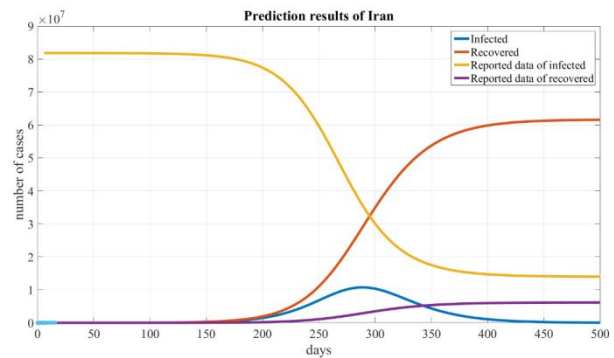
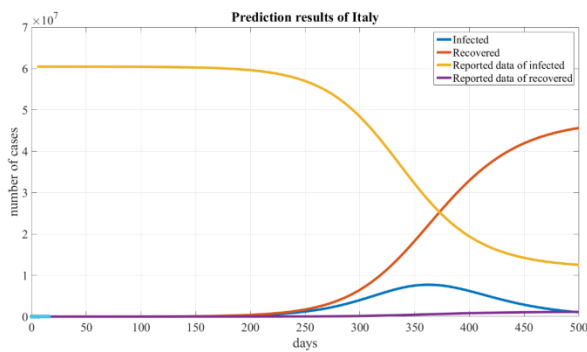
Japan reached 100 on February 21, 65 days to peak after the initial date, $r = 0.122$, value=1375

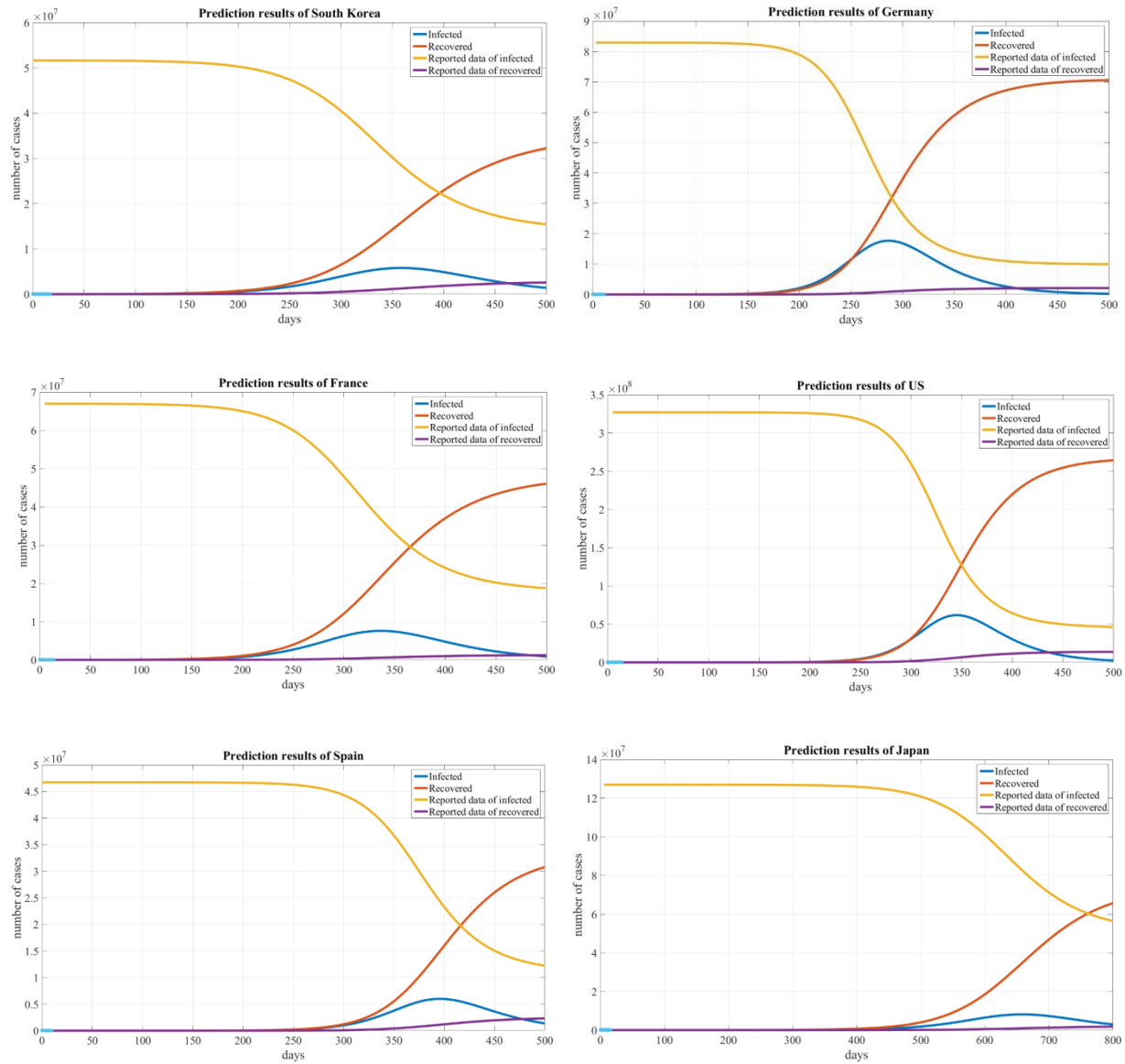




C. Basic SEIR model predictions (starting from the first day since the 100th confirmed case was reached)

Countries	Italy	Iran	South Korea	Germany	France	US	Spain	Japan
Initial Status								
Initial time	02/23	02/26	02/20	03/01	02/29	03/02	03/02	02/21
Initial value	155	139	104	130	100	101	120	105





D. Adjusted SEIR model predictions (data from the strict intervention and control measures were implemented)

Countries	Italy	Iran	South Korea	Germany	France	US	Spain	Japan
Initial Status								
Initial time	03/08	03/08	02/27	03/16	03/16	03/13	03/16	02/27
Initial Value	7375	6565	1766	7272	6633	2176	9942	214

