|  |  |  |
| --- | --- | --- |
| Open Cluster | Age (Gyrs) | Campaign |
| NGC 6811 | 1-2 | Kepler prime |
| NGC 2158 | 1–2 | K2 |
| Ruprecht 147 | 3–4 | K2 |
| NGC 1817 | 1–2 | K2 |

|  |  |  |
| --- | --- | --- |
| Cluster | Metallicity [Fe/H] | Helium abundance |
| NGC2682 | 0.000 Bossini  -0.029 Cameron (1985b)  -0.05±0.03 Janes & Smith (1984)  -0.06±0.07 Nissen et al. (1987)  -0.05±0.04 Noriega-Mendoza & Ruelas-Mayorgo (1997)  -0.04±0.03 Paunzen, E. et al. 2010  +0.00±0.06 Heiter, U. et al. 2013  +0.03±0.04 Pace, G., Pasquini, L., & François, P. 2008  −0.15 ± 0.05 (Age estimate = 4.2gyrs) Cole et al. (2004)  0.02±0.06 Salaris M. Weiss A. Percival S. M. , 2004  -0.05±0.04 J. L. MARSHALL. et al. 2005  -0.03 Tautvaisiene (2000) -0.01 Yong et al. (2005) +0.03 Randich et al. (2006) +0.03 Pace et al. (2008)  Other determinations: <https://iopscience.iop.org/article/10.1086/344161/fulltext/> | The physics of the best fit isochrone is with diffusion included, a mass-based overshoot, a mixing length of α = 2.0266, and an initial He abundance of Y0 = 0.248  <https://arxiv.org/pdf/1705.06761.pdf>  “We have also considered two chemical compositions: solar (Z=0.0188, Y=0.28) to represent the clusters NGC 188  and M67”  <http://articles.adsabs.harvard.edu/pdf/1995AJ....109.2090D> |
| NGC6791 | 0.400 Bossini  -0.08±0.07 Janes (1984) +0.50 - Kaluzny & Rucinski (1995) +0.05±0.05 Noriega-Mendoza & Ruelas-Mayorgo (1997) +0.00±0.14 Piatti et al. (1995) +0.094±0.141 Twarog et al. (1997) +0.45±0.04 Twarog et al. (2007)  +0.23±0.30 Paunzen, E. et al. 2010  +0.42±0.05 Heiter, U. et al. 2013  +0.11±0.10 Steven R. Warren, Andrew A. Cole. 2009  0.40±0.06 Salaris M. Weiss A. Percival S. M. , 2004  +0.40 Peterson & Green (1998)  +0.35 Origlia et al. (2006)  +0.39 Carraro et al. (2006)  +0.47 Carretta et al. (2007)  +0.30 Boesgaard et al. (2009)  “NGC 6791 is a very old (∼8.3 Gyr; Brogaard et al. 2012) and metalrich ([Fe/H] = 0.29 ± 0.03 (random) ±0.07 (systematic);  Brogaard et al. 2011) open cluster”  <https://iopscience-iop-org.ezproxye.bham.ac.uk/article/10.1088/0004-637X/757/2/190/pdf>  Other determinations:  [https://iopscience.iop.org/article/10.1086/344161 /fulltext/202236.tb12.html](https://iopscience.iop.org/article/10.1086/344161/fulltext/202236.tb12.html) | Y0 = 0.297 ± 0.003 and a corresponding age of 8.2 ± 0.3 Gyr. <https://iopscience-iop-org.ezproxye.bham.ac.uk/article/10.3847/1538-4357/ab0c04>  Y = 0.30 ± 0.01 <https://www.aanda.org/articles/aa/pdf/2012/07/aa19196-12.pdf> |
| NGC6819 | 0.000 Bossini  [Fe/H] = −0.02 ± 0.02  <https://arxiv.org/pdf/1501.04973.pdf>  +0.09±0.01 Heiter, U. et al. 2013  0.15±0.09 Salaris M. Weiss A. Percival S. M. , 2004  +0.07±0.24 J. L. MARSHALL. et al. 2005  +0.05±0.11 (age estimate = 2.3Gyrs) E. N. Thogersen et al. 1993  +0.09 Bragaglia et al. (2001)  “NGC 6819 is a middleaged (2–2.4 Gyr; Basu et al. 2011) open cluster, with solar metallicity ([Fe/H] = 0.09 ± 0.03; Bragaglia et al. 2001)”  <https://iopscience-iop-org.ezproxye.bham.ac.uk/article/10.1088/0004-637X/757/2/190/pdf> | Y= 0.28 <https://academic.oup.com/mnras/article/419/3/2077/1064418>  “we adopt in all three aforementioned codes the same hydrogen and heavy element abundances, which are X = 0.737 and Z = 0.018, respectively (Trampedach et al. 2014b).”: <https://academic-oup-com.ezproxye.bham.ac.uk/mnras/article/478/1/69/4978469> |
| NGC2158 | -0.36±0.18 Piatti et al. (1995)  -0.238±0.064 Twarog et al. (1997)  -0.29±0.09 Paunzen, E. et al. 2010  -0.48±0.11 Salaris M. Weiss A. Percival S. M. , 2004  -0.03 Jacobson et al. (2009) | “The isochrones adopted for this study were all computed for Y = 0.25.”: “THE OPEN CLUSTER NGC 2158” <http://articles.adsabs.harvard.edu/pdf/1985ApJ...299..683C> = |
| Ruprecht147 | Fe i = 0.16, Fe ii = 0.08  <https://iopscience.iop.org/article/10.1088/0004-6256/145/5/134#aj465235t3>  Ruprecht 147, which is reported to be  [Fe/H] = +0.10±0.04 by Curtis et al. (2013)  2.65±0.25±0.13 Gyr  2.48 ± 0.30 ± 0.13 Gyr  These are 2 different models that assume different Z values  <https://arxiv.org/pdf/1808.07482.pdf> | Not specific to the cluster but might be true for the milky way:  Y = 0.267±0.013 which is the mean helium by mass <http://articles.adsabs.harvard.edu/pdf/1980A%26A....81..375P> be warned this paper is from 1980 |
| NGC 6811 | 1. Bossini   “authors find NGC 6811 to have a sub-solar metallicity, however, the range of the reported values (−0.7 < [Fe/H] < −0.1 dex) is too large for computing accurate evolutionary and asteroseismic models of the cluster members.”  <https://academic-oup-com.ezproxye.bham.ac.uk/mnras/article/445/3/2446/1049858>  “NGC 6811, is characterized by a young (0.7 ± 0.1  Gyr; Glushkova et al. 1999) and possibly solar-metallicity  star population (suggested by two independent spectroscopic  investigations by H. Bruntt et al. 2012, in preparation, and J.  Molenda-Zakowicz et al. 2012, in preparation)”  <https://iopscience-iop-org.ezproxye.bham.ac.uk/article/10.1088/0004-637X/757/2/190/pdf> | Table 3  <https://academic-oup-com.ezproxye.bham.ac.uk/mnras/article/445/3/2446/1049858>  J. Molenda-Żakowicz et al. 2014: Spectroscopic study of the open cluster NGC 6811 |
| NGC752 | -0.030 Bossini  -0.06±0.03 Anthony-Twarog & Twarog (2006)  -0.311 - Cameron (1985b)  -0.26±0.06 Clariá et al. (1996)  -0.02±0.02 Nissen (1980)  -0.05±0.13 Nissen (1988)  -0.22±0.05 Piatti et al. (1995)  -0.21±0.09 Twarog (1983)  -0.160±0.040 Twarog et al. (1997)  -0.15±0.11 Paunzen, E. et al. 2010  -0.02±0.04 Heiter, U. et al. 2013  -0.09±0.06 Salaris M. Weiss A. Percival S. M. , 2004 | “The metal abundance of stars in NGC 752 does not  differ significantly from that of the sun.” <http://articles.adsabs.harvard.edu/pdf/1963ApJ...137..301G>  “We have also considered two chemical compositions:…Y=0.26 for NGC 752”  <http://articles.adsabs.harvard.edu/pdf/1995AJ....109.2090D> |
| NGC188 | 0.110 Bossini  +0.055 - Cameron (1985b) -0.16±0.11 Piatti et al. (1995) -0.046±0.098 Twarog et al. (1997)  -0.04±0.11 Paunzen, E. et al. 2010  +0.11±0.04 Heiter, U. et al. 2013  -0.03±0.06 Salaris M. Weiss A. Percival S. M. , 2004  +0.05 ± 0.38 (age estimate = 8.1Gyrs) E. N. Thogersen et al. 1993  +0.01 Randich et al. (2003)  Other determinations: <https://iopscience.iop.org/article/10.1086/344161/fulltext/> | “We have also considered two chemical compositions: solar (Z=0.0188, Y=0.28) to represent the clusters NGC 188  and M67”  <http://articles.adsabs.harvard.edu/pdf/1995AJ....109.2090D> |

Paunzen, E. et al. 2010: On the metallicity of open clusters\* I. Photometry = https://www.aanda.org/articles/aa/abs/2010/09/aa14131-10/aa14131-10.html

Table 1 from Paunzen which contains Fe/H measurements from other papers= <https://www.aanda.org/articles/aa/full_html/2010/09/aa14131-10/table1.html>  
Table 3 from Paunzen = <https://www.aanda.org/articles/aa/full_html/2010/09/aa14131-10/table3.html>

Heiter, U. et al. 2013: On the metallicity of open clusters II. Spectroscopy = <https://www.aanda.org/articles/aa/abs/2014/01/aa22559-13/aa22559-13.html>  
Salaris M. Weiss A. Percival S. M. , 2004 = <https://www.aanda.org/articles/aa/full/2004/04/aah4736/aah4736.html>  
E. N. Thogersen et al. 1993: <https://iopscience-iop-org.ezproxye.bham.ac.uk/article/10.1086/133304/pdf>  
  
NGC6791: 8.3 Gyr <https://www-aanda-org.ezproxye.bham.ac.uk/articles/aa/abs/2012/07/aa19196-12/aa19196-12.html>  
M67: 3.6 - 4.8 Gyr <https://arxiv.org/pdf/1705.06761.pdf>  
Helium choices from: Dana I. Dinescu – “THE AGES OF THE DISK CLUSTERS NGC 188, M67, AND NGC 752, USING IMPROVED OPACITIES AND CLUSTER MEMBERSHIP DATA” = <http://articles.adsabs.harvard.edu/pdf/1995AJ....109.2090D>

Metallicities of Old Open Clusters: Friel, Eileen D 2002

Solaris distance moduli and redenning: <https://www.aanda.org/articles/aa/full/2004/04/aah4736/table2.html>  
Some stellar G-band and Fe/H for M67 and NGC6819: <https://iopscience-iop-org.ezproxye.bham.ac.uk/article/10.1086/432685/fulltext/>  
some Fe/H for M67 and NGC752: ANDRZEJ STROBEL, Torun, Poland. 1990 = <https://onlinelibrary-wiley-com.ezproxye.bham.ac.uk/doi/epdf/10.1002/asna.2113120306>  
might already be the in the table but some other Fe/H values: Cameron 1985 <http://articles.adsabs.harvard.edu/pdf/1985A%26A...147...47C>

Collection of metallicities already put into the table: <https://www-aanda-org.ezproxye.bham.ac.uk/articles/aa/full_html/2010/03/aa12965-09/table13.html>

|  |
| --- |
| Other papers on abundance |
| NGC188, M67: <http://articles.adsabs.harvard.edu/pdf/1974ApJ...194..355M>  NGC752 : <http://articles.adsabs.harvard.edu/pdf/1963ApJ...137..301G> |
|  |
|  |
|  |

|  |
| --- |
| 146 TRAINING SETUP  folder\_name = '146'  load\_partially\_trained\_model = True  recompile = False  load\_RGB\_only = "EarlyType"  poly\_degree = 0  hidden\_layers = ['bn']+[128]\*10  activation = 'elu'  mean\_error\_type = 'MAE'  dropout = None  decay = None  momentum = 0 #between 0 and 1, setting momentum as 0 right now doesn't effect NAdam  opt = "Nadam"  reg = [['l2',1E-6]]  epoch\_no = [100,100,100,100,100,100,100,100,100,100,1000,3000]+[20000]+[2000]\*20  lr = [0.0001,0.0002,0.0005,0.001,'prev']  batch\_size = [1000,2000,5000,20000,50000,200000,500000,1000000,2000000,3000000] |
|  |
|  |

Kepler field of view: 19h – 21h, 25 - 50