|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Description | Ref |
| Surface area | μm2 | Total area of the surface of a solid 3D object. |  |
| Volume | μm3 | Space that is occupied by a solid 3D object with an enclosed surface. |  |
| Sphericity  (*ψ*) | % | Morphometric characteristic of shape which represents how spherical an object is. Sphericity *ψ* is defined as the ratio of the surface area of a sphere with the same volume *V* as the object to the surface area of the object *A*:  In the case of a sphere with volume and surface area , the sphericity formula is reduced to . For 3D objects which have , the sphericity . | [1] |
| Compactness  (*C*) | dim\* | Measure of shape compactness which represents the degree to which a shape is compact. The classical compactness of a solid 3D object is defined as the given ratio between surface area *A* and volume *V* of the object:  This measure is dimensionless and is minimized by a sphere with volume and surface area , having the most compact shape for . | [2] |
| Minimal distance | μm | Distance between centers of mass of FRCs in 3D Euclidean space, which is then minimized () by finding the nearest FRC neighbor. The distance between two FRCs *i* and *j* with Cartesian coordinates and respectively, is given by: |  |
| Connected protrusions | # \*\* | Number of protrusions per 3D reconstructed FRC body, counted before the first branching point and connected to another FRC. |  |
| Number of nodes | # \*\* | Total number of nodes *n* connected in a network. |  |
| Number of edges | # \*\* | Total number of edges for all nodes in a network. |  |
| Average number of edges per FRC | # \*\* | The arithmetic mean of the number of edges per node *i*, for the network with *n* nodes: |  |
| Average local clustering coefficient | % | The local clustering coefficient of a node *i* is defined as the number of edges among neighbors of *i* divided by the total possible number of edges among its neighbors:  where represents the number of neighbors of node *i*.  The average local clustering coefficient of a network with *n* nodes is the arithmetic mean of clustering coefficients of all the nodes: | [3] |
| Average shortest path length  () | dim\* | The average shortest path length *L* of a network is determined as the arithmetic mean of all pairs of shortest distances between nodes *i* and *j*: | [4] |
|  |  | where is the length (number of edges) of the shortest path between nodes *i* and *j*, namely how many nodes one needs to pass in order to get from node *i* to node *j*. The maximum distance is called the diameter of the network.  In case of a complete network where all possible connections are present, all the node distances , thus the sum , which gives the minimal . |  |
| Sigma factor  (*σ*) | dim\* | The small-world measure is determined by comparing the average clustering coefficient and average shortest path length of the network in question to an equivalent Erdos-Renyi random network with the same number of nodes and edges:  where and are the average clustering coefficient and average shortest path length of the random network, respectively, averaged across 100 simulation runs of an equivalent random network.  In the case of a random network , the sigma factor .  A network will be classified as a small-world network if which implies and and therefore . | [5,6] |
| Omega factor  (*ω*) | dim\* | The small-world measure is determined by comparing the average clustering coefficient of the network in question to that of an equivalent lattice network and comparing the average shortest path length to that of an equivalent Erdos-Renyi random network as follows:  In the case of a random network , the omega factor for , while in the case of a lattice network , will give rise to .  A network will be classified as a small-world network if it has average shortest path length like a random network and average clustering coefficient like a lattice network , which gives near-zero values .  Note that it is suggested that the small-world regime spans in the following range of *ω* values: . Although there is no precise cut-off, the proximity to zero indicates small-world network attributes. | [7] |
| Network robustness  (*R*) | dim\* | Network robustness can be assessed by sequentially removing *q* nodes from a network and is defined as:  where is the fraction of nodes *m* in the largest connected cluster (subgraph) when *q* nodes are sequentially removed over the number of nodes *n* of the initial network.  The largest connected subgraph must also satisfy the following two conditions:  1) Must have the largest number of connected nodes *m* and consequently the largest fraction .  2) The nodes *k* in the largest connected subgraph must be on average connected to at least two other nodes:  The largest connected subgraph is selected when both conditions are maximized and .  If no subgraph meets these conditions, the fraction .  Robustness of a network is calculated in the range of maximal vulnerability (*R=0*) and maximal robustness (*R=0.5*). | [8,9] |
| Average speed  () | μm/min | Average 3D speed of a cell is calculated as the mean of all cell velocities estimated at time points numbered with *t* and spanning 30 min time interval with time step as follows:  where *T* is the number of time points for 30 min total imaging time, is the estimated absolute speed of the cell over 20 sec time intervals , and specify the change in 3D cell position between consecutive time points *(t-1,t)*. |  |
| Arrest coefficient | % | Percentage of the time a cell spends travelling at speed less than 4 μm/min: | [10] |
| (*AC*) |  |  |  |
| Motility coefficient  (*MC*) | μm2/min | The motility coefficient of a data set can be derived from the mean displacement of all cells within the data set at time point *t = 1 min*:  The motility coefficient serves as a measure for area scanned by cells. | [11] |
| Meandering index  (*MI*) | dim\* | The meandering index, i.e. cell track straightness, is calculated as the ratio of cell displacement and total track length *L*:  The meandering index is a measure of movement straightness. A cell moving in an exact straight line will have *MI = 1*. | [12] |

**S1 Table References:**

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